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TITLE OF THESIS Classification Strategies of Eleven-year

olds as revealed by Verbal Explanations

of Grouping Procedures..................

DEGREE FOR WHICH THESIS WAS PRESENTED Master of Education

YEAR THIS DEGREE GRANTED 1977.........................

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CLASSIFICATION STRATEGIES OF ELEVEN YEAR OLDS
AS REVEALED BY VERBAL EXPLANATIONS OF
GROUPING PROCEDURES

by

Ⓒ ADRIENNE BARBARA COULL

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE
STUDIES AND RESEARCH IN PARTIAL
FULFILLMENT OF REQUIREMENTS FOR THE
DEGREE OF MASTER OF EDUCATION

DEPARTMENT OF ELEMENTARY EDUCATION

EDMONTON, ALBERTA

FALL, 1977

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend
to the Faculty of Graduate Studies and Research, for acceptance,
a thesis entitled "Classification Strategies of Eleven Year Olds
as Revealed by Verbal Explanations of Grouping Procedures"
submitted by Adrienne Barbara Coull in partial fulfillment of
the requirements for the degree of Master of Education.

ABSTRACT

The main purpose of the study was to examine the methods
or strategies of classification employed by a group of eleven_
year old children. By eliciting sorting behaviors and verbal
explanations of the responses provided, some insight into the
processes underlying concept development was sought.

The sample consisted of ten boys and ten girls at the
age of eleven years plus or minus four months. Intelligence
was not employed as a criterion for selection of the sample.

Two distinct tasks were individually presented to the
subjects. Responses were tape_recorded, transcribed and ana_
lyzed according to a common classification scheme. Anecdotal
observations were also recorded throughout task performances.

Verbal explanations were classified, and the proportion
of responses within each of four categories was determined for
each subject. Using a common criterion, the incidence of do_
minant preference as revealed by task performance was analyzed.

To determine the degree of flexibility within the classi_
fication strategies employed, a Multiple Classification Index
was devised and subsequently determined for each subject.
Results of this measure were statistically compared with per_
centile scores on the SAT Word Meaning Test, revealing no
significant correlation.

Upon examination of anecdotal observational records,
consistent behavioral characteristics were revealed among
the two groups distinguished for comparative purposes (inflex_
ible categorizers and flexible categorizers). Such charact_

eristics imply that the strategies available to an
individual for the processing of information may be related
to the subsequent organization of his cognitive structures.

Possible differences in performance or preferred strategies
between boys and girls were investigated by means of t_tests.
No significant differences were determined, leading the
investigator to conclude that classificatory behavior
appears to vary with the methods and materials of assess_
ment to a greater extent than it does with sex or vocabulary
test performance among eleven_year olds.

Suggestions for further research were outlined, and
implications arising from the study were discussed.

ACKNOWLEDGEMENTS

To the numerous people who provided their assistance, encouragement, time, and patience I extend my deepest gratitude and appreciation.

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CHAPTER 1

I. INTRODUCTION AND STATEMENT OF THE PROBLEM

The development of concepts has long been accepted as
a fundamental objective of education. As Kagan and Havemann
(1968) assert, "one of the measures of how much a person has
learned is how many cards are under each concept in his
mental filing system". (p. 204) Because a concept repre-
sents a mental construct, however, evaluation must of
necessity rely upon an indirect means of examination. The
problem, therefore, becomes one of discovering a reliable
means of identifying and assessing the concepts held by a
particular individual or group of students during a certain
period of cognitive development.

Traditionally, verbal definitions have been assumed to
constitute evidence of concept attainment. Although the
development of language is seldom synonymous with concept-
ual development, verbal responses do provide observable
indicators of related thought processes. As Frank Smith
(1975) states:

> certainly language does not exhaust
> the possibilities about all the
> different ways in which aspects of
> our thought may be organized. Words
> are the observable peaks arising
> from unexplored ranges of thought. (p. 23)

Thus vocabulary test scores provide the classroom
teacher with readily available information as to the
products of conceptual development. If the child is able
to supply the appropriate response, he is credited with

1

understanding of the related concept. Conversely, an
inappropriate response is interpreted as an absence of
associated meaning.

Such a view, however, assumes a direct relationship
between conceptual development and verbal expression.
Evidence to the contrary is presented by Russell (1956) in
his observation that:

> very young children may have concepts
> they are unable to describe in speech
> and older children may occasionally
> understand a concept which they are
> unable to explain in adequate words. (p. 123)

Concepts, therefore, must be viewed as being in a
constant state of flux rather than as static or stable
elements. In an attempt to make sense of the world, the
human individual actively seeks and processes input from
the surrounding environment. Since the sensations received
from external and internal stimuli as well as their subse-
quent organization are unique to the individual, the
evolving concepts which are formed are essentially idio-
syncratic in nature.

Because experience cannot be directly shared, it must
be transformed by means of the conventionally accepted
symbol system available within a particular society.
Through the development of language, individual contact
with the objective world may be mediated. At the same time,
language represents the principal means of classifying and
organizing experiences, thus facilitating conceptual
development.

The gradual development of classification schemes is
an essential prerequisite to the evolution of concepts. The
complexity of the environment bombarding the human individual
through his senses would be overwhelming unless the capacity
for classification were utilized. As Bruner (1956) contends,
without the ability to classify we would be "slaves to the
particular". (p. 1) Beardsley (1956) summarizes this thesis
in the statement:

> the fundamental way of organizing
> knowledge is that which consists in
> sorting things out _ that is think_
> ing of them as belonging to different
> classes of things. (p. 57)

When an object or event is in fact perceived, mental
processes are evoked whereby the occurrence is interpreted
and given meaning. Through the process of classification,
however, an ability beyond that of recognizing prior instan_
ces is gained. A 'rule of grouping' is also learned, thus
enabling the formation or attainment of concepts. As
Vinacke (1954) suggests:

> (i)n defining the properties of
> concepts we are really identifying
> the ways in which experience is
> organized in the mental context.
> (p. 527)

Revelation of such organization is generally assumed
from the verbal responses elicited through formal and
informal assessment conducted within a classroom setting.
As suggested in the Language Arts Handbook (Alberta
Department of Education, 1973), however, an examination of
the processes beneath the observable product should also

constitute an integral part of our diagnostic evaluation:

> ... (T)he teacher should be cautious in
> interpreting the child's behavior as
> indicative of his knowledge. At
> present, observing what the child
> does is the only way to get at his
> underlying knowledge or competence.
> It is this underlying knowledge that
> we are trying to expand in our
> language arts program, not just
> observable behavior or performance.
> (p. 152)

As a supplement to vocabulary measures, therefore, we must seek to understand the thought processes underlying such responses. By focussing attention upon the methods or strategies of classification employed by children, our endeavors to enhance conceptual development may be facilitated.

II. PURPOSES OF THE STUDY

The major purpose of the present study was to explore and describe the methods of classification employed by a group of similar-aged children. Through the presentation of selected stimuli, grouping and sorting responses were elicited and examined so as to determine the bases of classification used. In addition, a verbal explanation for each response was requested. Thus by adding an intro- spective dimension to the vocabulary measures available through test performance, it was considered possible to extend an understanding of the thought processes underlying verbal responses.

In his studies of thought, Bruner (1956) has primarily

been concerned with cognitive strategies _ "the means whereby

people reflect, retain and transform information" (p. vii).

Since concepts evolve through interaction with the environ_

ment, the methods or strategies of classification employed

must of necessity vary with individual experience. Both

the classes into which objects are 'sorted' (externally or

internally) and the reasons for such behavior will vary

with both the situation and the subject. Variation within

an individual as to the strategies utilized may in fact be

as wide as the variation between individuals. As Annett

(1969) points out, "methods of classification may well

change during the course of ontogenetic growth" (p. 223).

With this vast range of inter and inta_individual differ_

ences, investigation as to the nature of strategies

employed would constitute an insurmountable task were it

not for consistencies in human behavior. As Taba (1966)

states:

> presumably individuals have a
> predilection toward one or another
> way of selecting what they respond
> to in the environment and of
> organizing and processing their
> knowledge and perceptions. This
> predilection, or characteristic set,
> is the individual's cognitive
> style. (p. 3)

The construct of cognitive style was also explored

within the present study. An attempt was made to investi_

gate both the incidence and nature of dominant preference

as expressed by task performance.

III. RESEARCH QUESTIONS

To achieve the purposes of the study, answers to the following questions were sought:

Major Questions

1. What is the nature of classification strategies employed by eleven-year old children as revealed through verbal explanations of performance on sorting tasks?

2. What is the incidence and nature of dominant or preferred strategies for classification displayed by children of this age level?

3. Is it possible to devise means of determining the degree of flexibility within classification strategies?

4. What is the relationship between flexibility of classification and performance on a standardized vocabulary test?

5. Are there observable differences in performance among flexible and inflexible categorizers?

6. Are differences in performance or preferred strategies evident between boys and girls at this age level?

IV. DESIGN OF THE STUDY

Sample

Twenty children within the age range of eleven years plus or minus four months were selected from a heterogeneous Grade 5 classroom in the Edmonton Public School System. The sample was controlled by excluding students with known hearing or vision problems, students with English as a

second language, and students with known learning problems.
Intelligence was not included as a factor in selection of
the sample. Among the twenty students meeting these
criteria, an equal number of boys and girls was found to
be represented.

Instruments and Procedures

All subjects were individually interviewed on two
separate occasions. Responses were tape_recorded and
anecdotal observations were made. Two distinct tasks were
employed, each requiring a selection of stimuli which were
considered by the subject as belonging together. A verbal
explanation for each selection was elicited and recorded.

The first task involved an adaptation of the Sigel
Cognitive Style Test. The second task was designed for
the study and is henceforth referred to as the Coull Word
Sort Task. The Stanford Achievement Test in Reading was
administered by the classroom teacher and machine scored
by the testing services of the Edmonton Public School Board.
Percentile scores based on norms established for the system
were returned to the school used in the study, and these
scores were later made available to the investigator.

V. LIMITATIONS

The following factors limit the interpretations of the
findings:

1. Responses were elicited in a testing situation and may
   have been influenced by the presence of a taperecorder
   or the novelty of the stimuli employed.

2. It was assumed that verbal explanations provided were
   representative of the thinking employed. Thus bases for
   groupings were interpreted from the verbatim responses
   given. Although the common schema for classifying respon-
   ses used was determined to be reliable, some degree of
   subjectivity was involved in interpretation of responses.
3. Since each task required verbal explanations of the
   groupings employed, some children may have been limited
   by this mode of expression.
4. The relatively small sample size may have affected
   statistical analyses.
5. The sample was selected from the population of a hetero-
   geneous class. This population may or may not have been
   representative of a typical grade five classroom.

VI. SIGNIFICANCE OF THE STUDY

Since adequate diagnosis of concept development must
precede instructional planning, any forthcoming information
in this regard may prove useful as a supplement to that
provided by vocabulary test measures. In addition to
determining what words are known to a child, the classroom
teacher must be aware of how they are known. We tend to
assume that the 'average' child will have had sufficient
experience by the age of eleven to have developed a wide
repertoire of concepts. The depth and precision of these
concepts, however, may well be influenced by the strategies

of classification employed.

At the present time, we tend to assume a great deal about process by the product we perceive. In our endeavors as educators to enhance conceptual development, the import_ ance of language and its inter_relationship with thought processes must be kept in mind. In the words of Oyan (1967):

> (I)n the teaching of language and its
> use, each of us is contributing to the
> evolution of a dynamic force more
> potent than a cobalt bomb. (p. 170)

VII. OVERVIEW OF THE STUDY

Chapter I has introduced and stated the problem, discussed the purposes and research questions which guided the study, and outlined the design, limitations and signi_ ficance of the study. Chapter 2 reviews the literature and research pertinent to the study, thus providing a theoretical framework. Chapter 3 explains the design of the study. The sample, instruments and procedures, pilot study and analytic methods are described therein. Results of the study are analyzed and interpreted in Chapter 4. Chapter 5 contains the conclusions, implications and suggestions for further research.

CHAPTER 2

REVIEW OF RELATED LITERATURE AND RESEARCH

This chapter provides the rationale and background for
a study wherein the process of classification is viewed as
an essential basis for concept development. In Part I of
the chapter, a review of theories concerning the relation-
ship between language and thought is presented and discussed.
The developmental process of word meaning is briefly outlined
in Part II. Investigations within the area of vocabulary
assessment are also discussed. Part III of the chapter
discusses the process of classification. Reported findings
concerning the classificatory behavior of children are pres-
ented and discussed. Part IV provides a summary of diver-
gent theoretical views of concept development. Within Part
V of the chapter, the concept of cognitive style is briefly
reviewed. The chapter concludes with a summary of the
findings from the literature and research which are relevant
to the present study.

I. THE RELATIONSHIP BETWEEN LANGUAGE AND CONCEPTUAL ACTIVITY

Because thought is an internal process which cannot be directly observed, its existence and extent must of necess-ity be inferred. Since language serves as a record of conceptual activity which may be directly examined, it is by this means that mental processes are frequently 'assessed'. Although language does reveal a great deal about the thoughts behind words, the 'transparency' of the relationship may be misleading. As J. H. Newman warns:

> Nothing is more common than for man
> to think that because they are
> familiar with words, they understand
> the ideas they stand for. (in The
> Importance of Language, Black M.
> (Ed.), 1962)

Since an understanding of the relationship between language and thought is essential to any explanation of cognitive development, various theories have been proposed in this regard.

Although Vygotsky (1962) does not consider language and thought to be synonymous, he does emphasize the importance of the connection between them:

> Thought is not merely expressed in
> words; it comes into existence
> through them (p. 125).

And similarly:

> A word devoid of thought is a dead
> thing, and a thought unembodied in
> words remains a shadow. (p. 153)

Since Vygotsky considers the intellectual growth of the child to be contingent upon mastering the social means

of thought, he contends that language acts as a lure for
cognition. Although he stresses that language and speech
develop from different roots (thus necessitating a
prelinguistic phase of thought and a preintellectual phase
of speech), he visualizes the separate curves of develop-
ment converging and crossing at various points.

In concurrence with the theory proposed by Stern,
Vygotsky contends that the first crossing of language and
speech occurs with the discovery that everything has a
name. However he refutes Stern's claim that this point
marks the realization of the symbolic function of language.
Vygotsky alternatively suggests that such a realization
occurs later through a series of molecular changes. Thus
only by using language in a social setting does the child
gradually discover its significance.

According to Piaget, the child's use of language is
largely determined by the development of internal
organizational properties which he terms 'schemata'. By
acting upon objects in the environment, the child comes to
know and transform these objects. Through a process of
interaction, Piaget envisions the child as becoming
increasingly aware of the world around him, thus gradually
constructing a personal reality. Such an achievement is
truly remarkable, as exemplified in Piaget's (1969) words:

> None of these categories is given
> at the outset, and the child's
> initial universe is entirely centred
> in his own body ... In the course
> of the first eighteen months,
> however, there occurs a kind of
> Copernican revolution, or, more
> simply, a kind of general decentring
> process whereby the child eventually
> comes to regard himself as an object
> among others in a universe that is
> made up of permanent objects ...
> (p. 13)

Although Piaget readily acknowledges the usefulness

of language in advancing schematization and encouraging

abstraction, he views it as a facilitator of rather than a

prerequisite for cognitive growth. Since he views language

in its initial state as representing internal thought, he

contends that its appearance follows that of intelligence.

Bruner, in his studies of thought, has primarily been

concerned with the development of cognitive strategies. He

envisions the process of cognitive development as comprising

three stages or epochs _ the periods of enactive, iconic and

symbolic representation. These three forms of representation

constitute evolving strategies for conserving encounters with

the environment which are utilized during the growth of

human intellect.

Bruner contends that the first stage of cognitive

development involves knowing through doing, thus requiring

an active physical involvement with the environment. His

second stage, designated iconic, is marked by an ability to

translate reality through pictures or images. In the third

stage, translation through a symbolic means such as

language is achieved. Although a hierarchical structure

of development is outlined, Bruner (1973) stresses that

transition between stages is a gradual process:

> Growth involves not a series of
> stages, but rather a successive
> mastering of the three forms of
> representation along with their
> translation each into the others.
> (p. 317)

Like Piaget, Bruner views the process of cognitive

development to involve gradual qualitative rather than

quantitative changes in ability. Unlike Piaget, however,

he sees the place of language as guiding rather than

following thought. For Bruner, the internalization

of language constitutes an invaluable "cognitive instrument"

which may be readily utilized.

Russell (1956) has also contributed greatly to our

understanding of cognition. He emphasizes that thinking

should be considered as a process rather than as a static

condition or fixed state:

> Thinking is not knowing so much as it
> is doing, not cognitive so much as it
> is conative. (4)

Although he states that thinking may appear quite

different in varying situations, he outlines four major

factors or components of the thought process: materials,

motives, processes and abilities. Russell emphasizes,

however, that rigid distinctions or separations between

these components may not be readily observable. Rather,

Russell suggests that "the whole act of thinking is

characterized by organization and integration of the

various parts". (p. 8)

Because individual differences are both possible and
probable within each of the components, it is not surprising
that thought processes vary to the degree that they do. As
an aid to classifying thinking processes, Russell suggests
analysis in terms of the goal _ directedness of the
thinking event or type. Thus he distinguishes six types
of thought: perceptual, associative, inductive, problem
solving, critical and creative.

Throughout his discussion, Russell stresses the
symbolic nature of thinking. Although the symbols involved
are frequently verbal, they may also be images or precepts
based on memory or sensation. Regardless of their source,
the use of symbols represents both a liability and a
tremendous asset. As Russell (1956) asserts:

> ... the symbolic nature of thinking is
> one of the main reasons children
> have difficulty in thinking clearly
> and accurately. On the other hand,
> verbal symbols are one of man's
> great inventions in the process of
> communicating ideas. Without
> symbols, the system of language and
> civilization as we know it simply
> could not exist. (p. 24)

II. THE DEVELOPMENT OF WORD MEANING

The acquisition of language involves a gradual
accumulation and elaboration of verbal symbols. By means
of these symbols, the individual's conception of the world
around him may be represented and communicated. Unlike
other animal species, however, man's means of communication

is not a biological 'given'. Experience must be trans-
ferred since it cannot be directly shared. The means of
sharing exists in the conventionally accepted symbol system
of a particular society. As exemplified in the words of
Church and Stone (1973):

> We might insist that it is only by
> becoming a linguistic organism, by
> understanding speech and by speaking,
> that the child gains access to full
> status as a human being. (217)

As the child gains linguistic ability, his world may
be voluntarily extended in terms of both time and space.
Symbols enable a delayed reaction to the stimuli of the
external world through a mediated act of knowing. As
Langer (1957) points out, however, "true language begins
only when a sound keeps its reference beyond the situation
of its instinctive reference" (p. 105)

In the initial stages of language development,
Vygotsky (1962) contends that the word associated with an
object actually constitutes an attribute or property of
the object. External structure is grasped before the inner
symbolic "meaning" is realized. Only in the process of
operating with words is the denotative or referencing
function of language discovered. Until such time, Vygotsky
would insist that the child's usage of words coincides with
that of adults in its objective reference but not in its
meaning. The discovery and creation of meaning, in fact,
constitutes a life-long process.

Throughout this period of evolution, individual conceptions of the world as well as the range of meanings ascribed to particular words reflect an accumulation of direct and 'languaging' experiences. During the course of development, according to Vygotsky, change in word meaning may be noted in two distinct directions. As meanings associated with words gradually become more generalized, they come to encompass a greater number of representative instances. Conversely, as perceptual and discriminative abilities improve, particular instances may be excluded from the original meaning as more specific labels are acquired. Thus the alternate processes of generalization and differentiation constitute a means of refining a shared system _ a means of communication.

Although language begins with its denotative or referencing function, it fails to remain within the realm of observable referents. Because of unique experiences within his environment, the human child attaches personal or connotative meaning to words as well. Thus in determin_ ing the development of word meaning in young children, the internal process and its direction must frequently be inferred. As Lewis (1963) contends:

> we have to remain unaided by anything
> the child can tell us of himself; we
> have to infer what is going on 'in his
> mind' from what we can observe of him,
> other children and ourselves .. (p. 36)

The importance attached to the words actively used by children is reflected in the number of studies that have been done in this area. As far back as 1904, Chambers investigated the growth in general meaning of words. Before the 1950s, studies were predominantly concerned with the quantity of words used and 'understood' by the child. (e.g. Smith, Thorndike).

The beginning of a new era, however, was marked by a study by Feifel and Lorge in 1950. Evidence of significant differences in the qualitative responses of younger and older children in their study set a precedent for future investigations. (e.g. Binet and Simon, Kirkpatrick, Gray and Holmes).

A developmental study which endeavored to investigate the processes underlying the acquisition of word meaning was undertaken by Werner and Kaplan (1950). By designing a word-context test which employed artificial words embedded in sentences, they were able to investigate the processes of signification (ways meanings are given to words) used by children between the ages of 8.6 and 13.5.

Upon analysis of both the quantitative and qualitative aspects of their findings, Werner and Kaplan reported significant trends in the process of signification. A steady increase of correct solutions with age provided support for a developmental view of the establishment of word meaning.

An increasing conventionalization of meaning with age was also demonstrated, leading Werner and Kaplan (1950) to infer a subsequent "increasing understanding that verbal symbols are standard tokens of communication". (p. 76) Finally, in examining the signification processes used by subjects at various levels of maturity, evidence of both gradual and saltatory change was concluded.

This latter finding was interpreted as evidence of developmental shifts during the course of ontogenesis. In proposing a spiral view of development, Werner and Kaplan (1950) suggest:

> Mental growth, rather than being conceived as a straight increase of achievement is here seen as a sequence of rises and declines of processes, subserving each achievement. (p. 96)

According to Werner and Kaplan's Principle of Spirality, levels of cognitive functioning may vary within the indivi_ dual according to internal or external conditions. Thus even though higher levels may have been attained, lower or more primitive levels may come to the fore in the event of novel or difficult tasks. Similarly, in the establishment of word meaning, a linear progression is seldom evident. As summarized in a later publication, Werner and Kaplan (1963) assert:

> At a certain point in development, words come to acquire meanings relatively independent of specific, concrete contexts of application, that is, words become lexicalized.

> This process of establishing a stable,
> relatively general meaning for words,
> a meaning which transcends specific
> significances of a word in different
> contexts, is a long and difficult one.
> (p. 190)

Russell and Saadeh (1962) extended vocabulary research in yet another way. As they contend:

> (t)he important fact about a child's
> vocabulary may be, not the number of
> words he recognizes superficially,
> but the quality of his associations
> with different words. (p. 170)

Accordingly, they investigated qualitative levels of response in a recognition situation.

Specifically, these researchers sought information regarding the preferred choice of definition selected by pupils in third, sixth and ninth grades. The instrument used was a multiple-choice test of forty words, each defined in a concrete, functional and abstract manner. With alternative meanings thus available, the level of meaning selected by each child as 'the best' could be ascertained.

Results revealed some dominance of concrete and functional choices by the younger children. The number of functional and abstract choices increased in the later grades, with a corresponding decline of concrete choices. Similar results were obtained in a later study by Lundsteen (1974).

Investigations within the area of vocabulary development have also been conducted at the University of Alberta. In these attempts to explore the nature and growth of word

meaning, diverse methods and approaches are evident.

Evanechko (1970) elected to investigate the nature of semantic processes through a hypothetical multidimensional view of 'semantic space'. He identified twenty-four possible categories of meaning and subsequently designed a Semantic Features Test to determine the methods of ascribing meaning actually utilized by children. By means of performance results, he was able to infer both the level and adequacy of conceptual functioning thus revealed. His findings suggest that older students demonstrate a greater degree of both depth and variety in their word meanings, leading him to conclude:

> (M)eaning, therefore, is the result
> of a strategy employed in relating
> the word to kinds of semantic
> relations and a function of the
> cumulative history of the language
> user. (p. 32)

The major focus of Laing's (1974) study was the processing of word meaning. By means of introspective techniques, she explored the ways in which meaning was obtained from context. In agreement with McCullough (1959), she emphasized that "use of a word is no guarantee that meaning has been grasped" (p. 102). Thus by examining products in relation to subjects' verbalized explanations of the process utilized, she discovered that facility in the use of contextual clues appeared to influence performance. By placing unknown words in context

(sentences and paragraphs), the methods of obtaining meaning utilized were individually diagnosed. Subjects appeared to relate meaning cues to their background knowledge and experience, thus leading her to conclude that meaning seems to be obtained by an integration or synthesis of several related segments.

In his study, Nixon (1975) voiced a concern for the discrepancy between strategies of meaning available to a child and those he actually uses. Accordingly, Nixon undertook an examination of both the commonality and variability of word meaning as expressed orally by children. Upon completion of four tasks, individual responses were analyzed according to nineteen categories of meaning. Results included a discovery that "overall patterns of growth in word meaning appeared to be influenced by the nature of the stimulus, the nature of the task, and the chronological age of the subjects". (p. vi)

The diverse and varied research methods reported briefly herein attest to the difficulties inherent in 'measuring' word meaning. Since direct assessment of knowledge is impossible, we are largely dependent upon verbal response for our evaluation of competence. Reliance upon isolated vocabulary test results, however, has frequently been demonstrated to be both misleading and insufficient in terms of the information

provided. As well as determining what words are known by the child, it is essential that we attempt as well to discover how these words are known.

Brown (1962) points out that vocabulary tests generally deal with single responses rather than the range of meanings attached to any particular word. When a 'correct' response is made on such a test, the individual is credited with full understanding. Although this knowledge may in fact be present, the possibility of isolated competence must also be considered. Similarly, Langer (1967) warns of the difficulties inherent in over_simplifying the various dimensions of word meaning:

> The word_in_itself is devoid of meaning
> if the user has no concept for it.
> Conversely, the word for which one has
> a multitude of associations can be a
> rich and varied experience. (p. 455)

In their book "Language Use and School Performance", Cicourel et al (1974) emphasize that the conception of a 'correct' response on a standardized vocabulary test implies that meaning is a 'given'. This in turn necessitates a view of students as passive recipients who simply respond to stimuli from the environment. In criticizing such a view, they point to an alternative perspective. In the words of Erickson:

> To experience something as something is
> to experience and interpret that something
> in terms of one's world. Had one no world,
> one would have no cognitive experience at
> all. Thus one's world serves as a necessary
> condition for the possibility of anyone's
> experience. (in Cicourel et al, 1974, p. 220)

Proceeding from this perspective, Cicourel et al aptly demonstrate that obtaining the 'correct answer' on a

standardized vocabulary test actually depends upon the
child's ability to identify a frame of reference which
corresponds to that of test constructor. If this 'second
guessing' is unsuccessful, no opportunity is forthcoming
whereby the child may justify and explain the reasoning
behind his own definition or choice.

Thus describing a child's performance by such a score
is, in the view of these authors, comparable to judging an
iceberg by its tip. Accordingly, Cicourel et al (1974)
contend:

> This means we have to go beneath the
> score as a summary of a complicated
> and only partially formulated
> interaction and attempt to describe
> the behavior of the test partici_
> pants. (p. 252)

III. THE PROCESS OF CLASSIFICATION

As previously stated by Sapir, language represents a
unique system of voluntarily produced symbols enabling the
communication of ideas. Before such relationships may be
established, however, the world of experience must be
enormously simplified and generalized. This is largely
accomplished through conventional association of particular
symbols with classes or categories of experience. In the
words of Roger Brown (1958):

> Any sort of recurrence in the non_
> linguistic world can become the
> referent of a name and all such
> recurrences will be categories
> because recurrences are never

> identical in every detail.
> Recurrence always means the
> duplication of certain essential
> features in a shifting context
> of non_essentials. (p. 8)

Implicit in this process of categorizing is the ability

to abstract or infer information from the memory data of

experiences. In discussing the process of abstraction,

Hayakawa (1962) contends that our nervous systems automa_

tically abstract or select similarities. Initially,

resemblances are noted while differences are ignored. Thus

in the early stages of development, the child has a tendency

to overgeneralize _ to include objects in a class which are

later discovered to be discriminably exclusive.

Hayakawa (1962) in his discussion of classification

emphasizes that "the individual object or event we are

naming has no name and belongs to no class until we put it

in one" (p. 254). As he illustrates, however, this arbitrary

act of inclusion greatly affects both our attitude and future

actions:

> (T)hese are not informative state_
> ments but directives, directing us
> to classify the object or event
> under discussion in given ways, in
> order that we may feel or act in
> the ways suggested by the terms in
> the classification. (p. 259)

Hayakawa provides an example of the effects of

classification by analyzing how variation in interpretation

of a concept defined as 'one person who killed another' may

well affect our resulting behavior. Depending on how we

classify the act (as murder, temporary insanity, homicide, an accident or heroism) our behavior will vary accordingly. As Hayakawa (1940) suggests:

> (w)e hang the murderer, lock up the
> insane man, free the victim or pin
> a medal on the hero. (p. 154)

According to Britton (1970), the process of classifica_ tion begins when a name or label is attached to an object. Beginning with specific and narrow categories, alternate refinement and expansion progressively enables the hier_ archical organization of a cognitive system. By means of language, an individual representation of the world is created.

In discussing the organization of cognitive structures, Frank Smith (1975) distinguishes three distinct aspects which may be traced developmentally. Initially, we distinguish many categories or classes of objects, reflecting a need for regarding objects and events as the same or different. Smith emphasizes that "the basis upon which categories are established may be determined as much by the individual who is doing the organizing as by the objects being organized" (p. 14). A particular method of categorization is, therefore, selected because of its utility rather than because of its 'correctness'.

Initially, similarities or resemblances are noted, while differences are ignored. Thus in early stages of development, the child has a tendency to overgeneralize _

to include objects in a class which are later discovered to be discriminably exclusive.

With increasing experience, finer distinctions between categories become evident. To make his cognitive category system functional (to permit a match of his 'personal categories' with those of his society), the child must discover predictable means of identifying objects and events. This is largely accomplished by attention to distinctive features, thus increasing the degree of dis- crimination required for inclusion within a particular category.

Finally, Smith contends that interrelations among categories must be discovered and utilized before the environment can be made meaningful. It is by this means that an individual cognitive system becomes organized. As he emphasizes:

> These interrelations are the core of
> the entire cognitive system of our
> theory of the world. They enable us
> to summarize past experience, make
> sense of the present and predict the
> future. Nothing in our lives would
> be comprehensive if those inter-
> relations were absent. (p. 17)

One available means of relating cognitive categories is by reference to class inclusion. Almost all objects which we experience may be assigned more than one name (placed in more than one category). When required to explain or define what we mean by a word, we frequently

begin by giving it another name. For example, if required to explain what a dog is, we may describe it as an animal. By doing so, we place the object into a broader, more inclusive category. Conversely, we may specify a smaller subcategory to which an object belongs, thus emphasizing the distinctiveness of an object.

Categories that can thus be "embedded" within one another are frequently referred to as having a hierarchical relationship. These broader categories which indicate ways objects may be regarded as similar despite their individual differences, are referred to as superordinate. Those which may be separated or distinguished constitute subordinate categories.

This hierarchical relationship is generally described as one of class inclusion, but for reasons of convenience is designated by Smith as an isa (pronounced izza) relationship. When represented diagrammatically, the connections between categories become readily apparent.
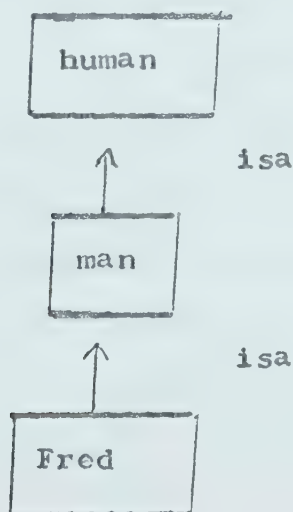
Thus the lower-order categories or classes are included
within the higher-order ones. Conversely, the lower-order
categories may be termed exemplars or instances of the
higher-order categories.

A second type of cognitive relationship which may be
verbally indicated is that of property relations. An object
is frequently distinguished by reference to an attribute or
quality which it possesses. By the use of the word is
without an article (such as 'Fred is tall'), this relation-
ship may be revealed.

The importance of category interrelations is also
emphasized by Britton (1970):

> It is not simply in the number of
> categories they possess that men
> are superior to dogs, but also in
> the inter-relatedness of the
> categories. Language, because of
> its own highly complex internal
> organization, provides us with
> systematically related categories
> of many kinds. (p. 27)

Relationships which Britton considers to be 'built into'
language include synonymity and oppositeness. In accordance
with Smith, however, he considers the most powerfully useful
relationship to be that of hierarchy.

The establishment of such a hierarchical system
necessitates a corresponding development of the ability to
abstract. According to Sigel's (1953) definition,
abstraction represents "a mental process in which some
attribute or characteristic is observed independently of

other characteristics of an experience as a whole" (p. 131).
In the course of his investigations, Sigel has sought
information regarding developmental trends in abstraction
ability among children.

As Sigel (1953) reports, differing organizational
patterns of response to environmental stimuli have been
widely observed. (Werner, Welch, Thompson etc.) There has
been general agreement that responses in very young
children are made primarily on a sensori-motor level. Such
responses have been designated as perceptual. With
increasing experience and maturity, the child becomes able
to consciously impose organizations upon the environment,
thus attaining a conceptual level of abstraction.

Sigel's (1956) study utilized an object sorting test
requiring sixty subjects (aged seven, nine and eleven years
old) to spontaneously group twenty-four familiar items,
then explain the reason or basis for each grouping.
Designations of groupings were scored as perceptual,
conceptual or miscellaneous (heterogeneous combinations).
Results indicated downward trends in the use of perceptual
categories with age, and upward trends for conceptual
classifications. Although group trends support a
developmental view, individual variations within the groups
were much less consistent. Regarding these variations,
Sigel (1956) concludes:

(w)hether vocabulary, unique experience
favoring concept formation, certain
types of innate ability, maturational
factors, or personality determinants
affect the abilities of the youngsters
is still an open question. (p. 141)

Jerome Bruner and his associates have investigated
such variations in individual ability extensively. In
Bruner's view, the process of categorizing involves an act
of invention. Thus he postulates the individual development
of a 'coding system' - a particular manner of grouping and
relating information about the world. This development he
envisions as a dynamic process in which there is a successive
translation from one mode of representation to another.

According to Bruner (1962), the capacity for categoriz-
ing experiences has many beneficial results. The following
achievements are thus attributed to classificatory behavior:

"(1) reducing complexity of the environment
(2) identifying objects
(3) reducing the necessity for constant
learning
(4) providing direction for activity
(5) providing opportunity for ordering
and relating classes of events".

In his discussion of categorization, Bruner (1956)
distinguishes between identity and equivalence categories.
Identity categories involve the classing of a variety of
stimuli as forms of the same thing. Equivalence categories,
however, are characterized by responses to a set of discrim-
inably different things as amounting to the same thing. (p. 3)
These responses may involve affective, functional or

formal components. Both systems of categorization, however, are dependent upon what Bruner identifies as "the acceptance of certain properties as being criterial or relevant, others as being irrelevant". (p. 30)

In rejecting the usual passive view of association which delineates the linking of objects or events through some con_ tiguity of space or similarity, Bruner (1965) asserts:

.. associations do not just happen,
.. they are governed by certain rules, and
these are the result of certain rather
complex transformations imposed on data
by active, collective, limit_bound,
talking organisms. (p. 126)

The developmental process of equivalence categories was investigated by Bruner and Olver (1965) using subjects from the first, fourth and sixth grades. A task was specifically designed to measure "the manner in which subjects of different ages im_ pose a similarity transformation on a set of verbally presented materials and the way in which this transformation is conserved or altered in the face of difficulties". (p. 128)

Several different forms of strategies of grouping were analyzed following completion of the task. The first form of grouping was designated as superordination where items were grouped on the basis of one or more common attributes (functional properties, perceptible qualities or affective reactions). A second range of responses was referred to as complex formations. This type of strategy was ascribed to a process of selecting attributes from the entire array without an explicit statement of commonality. Elements appeared to be

grouped together on the basis of associational links from one to the other. The final form identified was that of thematic grouping, where elements were incorporated within a story or hypothetical happening.

Results obtained revealed a steady increase in the use of superordinate strategies and a decline in complexes with age. From these findings, an inference was made by Bruner and Olver (1965) that "what distinguishes the young child from the older child is the fact that the young one is more complicated than the older one, not the reverse" (p. 134). Accordingly, Bruner (1965) stated a first developmental theorem emerging from these investigations:

> The development of intelligence, given intervening opportunity for problem solving in the life of the growing organism, moves in the direction of reducing the strain of information processing by the growth of strategies of grouping that encode information in a manner (a) that chunks information in simpler form, (b) that gains correctedness with rules of grouping already formed, and (c) that is designed to maximize the possibility of combinational operations.
> (p. 134)

A study of methods of classification utilized by subjects of various ages was undertaken by Annett (1969) in an attempt to trace some aspects of conceptual development. Fundamental to her investigation was a hypothesis that "concepts involve the classification of experiences, and methods of classification may well change during the course of ontogenetic growth".

Using a large sample of both children and adults, she devised a common task requiring the sorting of sixteen pictures

of common objects. Objects portrayed represented four recog-
nizable 'groups' - animals, plants, vehicles and articles of
furniture. Although wide variability at all ages was demon-
strated in both the number of groups formed and the number of
cards in a group, a clear rise of within group sortings and a
decline of cross group sortings with increasing age was evi-
dent.

Explanations provided for individual groupings were then
analyzed according to a common classification scheme. The
five types of explanation distinguished were: (1) no explana-
tion, (2) enumeration, (3) contiguity, (4) similarities and
(5) class names.

Upon analysis of explanations according to this scheme,
no significant differences between the sexes were evident.
The frequency of 'no explanation' was found to decline sharply
with an increase in age. Enumeration as the only explanation
of a sorting exhibited a similar decline after the age of
seven. Contiguities were seen to rise and fall with a peak
at the age of eight, then rise again in older adults.
Similarities showed a roughly linear rise with age, but were
less frequent in adults where class names were distinctly
predominant as the 'preferred' method.

Although some evidence of a developmental sequence in
methods of classification was revealed, intra-individual
variation in method was also evident. In discussion of her
findings, Annett (1969) alludes to such variation:

> Many adults, like the children, use
> more than one method of explanation,
> going from one type to another with-
> out any awareness of the change or
> that one method may be better than
> another. (p. 235)

Developmental trends in the acquisition of natural language categories have subsequently been investigated by alternate means. Saltz, Soller and Sigel (1972) utilized printed labels and picture cards of familiar objects in their study, thus enabling an examination of the range of categorization evident at various ages.

The method adopted for such examination involved the individual selection of picture cards which were deemed to illustrate instances of the various concepts identified on the word cards. Responses were then analyzed, revealing age differences in both the quantity and quality of categorization.

Two major developmental trends were revealed by this analysis. First, the younger children (age 5-6) consist- ently included a smaller number of items within each class as compared to older children (age 11-12). Concept names or labels were often used in very narrow and specific ways by these younger children, with integration of meaning showing a developmental trend. This finding led the authors to infer an initial tendency toward making over-discrimin- ation rather than over-generalization errors in the use of concepts. Such a view is supportive of that expressed by Bruner and Olver (1965) - that the younger child is more complicated than the older.

A second finding reported by Saltz, Soller and Sigel (1972) is an increased dependence upon perceptual attributes in the case of the younger children. With older subjects, a decreasing tie to such attributes was evident.

Nelson (1974) took a somewhat different approach in her investigation of natural language categories. Rather than requiring identification of members or common attributes from among a predefined group of instances, she elected to use a production paradigm. Based upon the free recall of instances from semantic memory, her subjects were requested to list all of the things that belonged with each word presented verbally. Results indicated that the size of categories (number of instances thus produced) increased with age, but contrary to the findings of Saltz, Soller and Sigel, little variation with age in reliance upon perceptual attributes was revealed.

Despite the diversity of research methods and findings reported herein, investigations into classificatory behavior do represent an observable means of assessing concept attainment. In the words of Johnson and O'Reilly (1964):

> A concept is not an observable stimulus
> or an observable response, but it can
> be reasonably treated as a hypothetical
> construct with specified relations to
> these observables. A concept is related
> to observable classifying responses in
> that one who "has" the concept makes
> sorting and labelling responses that
> others do not make, and it is this type
> of response that has been used most
> often in the laboratory. (p. 71)

IV. CONCEPT DEVELOPMENT

The importance of concepts in human development is
readily acknowledged. As expressed by Klausmeir et al (1974):

> Despite the large differences in level
> of understanding, concepts are the
> fundamental agents of thought for human
> beings from early childhood through
> adulthood. (p. 1)

Accordingly, a substantial amount of research as to the nature
of concepts has been conducted during the recent past. Despite
the diversity of experimental methods employed and develop‑
mental theories put forth, however, the process of concept
formation is not yet completely understood. In his
discussion of the divergent theoretical explanations which
have been proposed, Flavell (1970) goes so far as to suggest:

> The various characterizations are far
> from identical, needless to say, and
> after pondering on them for a while
> the reader is tempted to think that
> their most important similarity is
> their common inadequacy. (p. 983)

In reviewing the considerable mass of literature related
to concept development, a distinction may be drawn between
investigations concerned with the teaching and learning of
specific concepts (usually in a laboratory setting) and
literature which provides an overall theory of the process
itself. Since the present study concerns a description of
classification strategies, focus has been directed to the
latter body of research.

Extensive investigation in the area of concept formation
has been conducted by Jerome Bruner and associates. Implicit
to his view of the nature of concepts is the postulation of a

gradually developing network or system of equivalent responses. In addition to permitting the identification and classification of stimuli, such a system also provides a means of cognitive mediation, thus enabling the human individual to go beyond the information given. As Bruner and his associates (1956) state:

> We .. regard a concept as a network of
> sign _ significate inferences by which
> one goes beyond a set of observed
> criterial properties exhibited by an
> object or event to the class identity
> of the object or event in question,
> and then to additional inferences about
> other unobserved properties of the
> object or event. (p. 244)

In his investigations of concept formation, Bruner (1962) has emphasized the importance of attributes as signals. Although he defines an attribute as "any discriminable feature of an event", he contends that concept attainment involves the discovery of predictive or defining attributes, thus making discrimination possible. These defining attributes enable prediction and identification of future instances _ they become in fact criterial attributes.

If such a characterization of concepts is accepted, all behavior may in a sense be termed conceptual since we tend to respond to the regularities rather than the uniqueness in our environment. Thus variation in conceptual development may be attributed to differences in the division or categorization of the individual's experiential world. Accordingly, concepts are essentially idiosyncratic in nature, but may be revealed through observable performance. As suggested by Bourne et al (1971):

> A person understands a concept when he
> can identify and employ instances of
> the regularity in a manner appropriate
> to his circumstances. ... To learn a
> concept is to acquire an understanding
> of a formerly unrecognized regularity.
> (p. 177)

In utilizing the capacity for classification, the human
individual must therefore abstract or infer information from
the sensory data of experiences. As new associations are
discovered and refined, a subsequent shift in the meaning of
concepts occurs. Thus the complementary processes of
abstraction and generalization enable individual organization
and interpretations of sensations received from both external
and internal stimuli. As suggested by Russell (1956)
"generalization plus differentiation produces a concept".
(p. 119)

Concepts, however, are seldom developed or utilized as
discrete or isolated units. As Russell (1956) suggests,
"concepts are not single stalks of wheat in separate rows,
but a wheat field waving as one in the breeze". (p. 125)
In the course of cognitive development, discrimination among
and interrelations between various classes must also be dis-
covered. Through a gradual evolutionary process, the
relationship of words and their denotative meanings becomes
internalized. In the words of Vinacke (1951):

> In general, concepts represent regulating
> (or selective) systems in the mental
> organizations of the individual _ systems
> which link separate sensory impressions,
> which depend upon past experience, and
> which are organized apart from direct
> sensory data. (p. 26)

In tracing the evolution of concepts, Vygotsky (1962) describes three phases of development. During what he terms Phase One, objects are linked in the child's perception by chance occurrence. Thus he refers to this developmental period as one characterized by the assembling of heaps.

As bases for grouping become more clearly organized, Vygotsky envisions a progression into Phase Two of development. During this period, various bonds and relationships are established, thus permitting the formation of word families. Bonds formed at this time, however, remain concrete and factual rather than abstract or logical. Thus Vygotsky considers this phase of development to be characterized by thinking in complexes.

Only during the final stage of development, occurring at about the time of puberty, does Vygotsky recognize the advent of true concepts. At this time, he considers that "the child's mental development itself has reached the requisite level" (p. 82) to permit concept formation. An analysis of Vygotsky's view of the process involved is contained in his statement:

> Concept formation is the result of a
> complex activity, in which all the
> basic intellectual functions take
> part. The process cannot, however,
> be reduced to association, attention,
> imagery, inference or determining
> tendencies. They are all indispen
> sable but they are insufficient
> without the use of the sign, or
> word, as the means by which we direct
> our mental operations, control their
> course and channel them toward the
> solution of the problem confronting
> us. (p. 58)

The developmental aspect of concept formation is also stressed throughout the work of Jean Piaget. He considers concepts to be synonymous with schemata, defined as "cognitive structures used to process and identify incoming stimuli". (in Wadsworth, 1971, p. 101). As the child develops and his experiences broaden, Piaget would contend that schemata become both more numerous and more refined.

These changes in Schemata are accounted for by the postulation of two alternate processes. According to Piaget, the process of assimilation permits the expansion of schemata, thus allowing the organization of new stimuli into existing schemata. When assimilation is impossible because of unique characteristics of a new stimuli, the process of accommodation comes into play. This process permits the modification of existing schemata or the creation of new schemata as necessary.

To ensure an internal balance, Piaget proposes a condition of equilibrium towards which the child strives so as to achieve consistency within his cognitive structures. Thus for Piaget, concept development is accounted for by a cumulative integration of experiences.

Despite the apparent consensus with regard to the developmental aspect of concept formation, Vygotsky and Piaget differ strongly as to the effects of instruction. Piaget views readiness as a function of general cognitive maturity. Thus he plays down the influence of verbal adult.

child interaction, claiming that the child's activity rather
than his language is the main factor in his cognitive devel-
opment. Piaget (1965) illustrates this view in stating:

> It is a great mistake to suppose
> that a child acquires the notion of
> number and other mathematical concepts
> just from teaching. On the contrary,
> to a remarkable degree he develops
> them himself, independently and
> spontaneously. When adults try to
> impose mathematical concepts on a
> child prematurely, his learning is
> merely verbal; true understanding
> of them comes only with his mental
> growth. (p. 406)

According to Vygotsky, (1962) however, both instruction
and imitation play an important part in conceptual develop-
ment. Thus he contends:

> What the child can do in cooperation
> today he can do alone tomorrow.
> Therefore the only good kind of instruction
> is that which marches ahead of develop-
> ment and leads it. (p. 104)

In his discussion of the concept of readiness, Bruner
presents a view similar to that of Vygotsky. Bruner (1973)
suggests:

> Readiness is a half truth because
> it turns out that one teaches read-
> iness or provides opportunities for
> its nurture, one does not simply
> wait for it. (p. 473)

In the tradition of information - processing theorists,
Klausmeir et al (1974) also contend that concepts are learned
rather than emerge through maturation. In a conceptual
learning and development (CLD) model, they outline four
successive levels of concept attainment: concrete level,

identity level, classificatory level and formal level.
The cognitive operations involved in attainment at each
level are specified. With each successive level,
Klausmeier et al suggest that the stimulus properties
which are processed become increasingly more sharply
differentiated and abstracted. Accordingly, the concept
attained becomes increasingly usable and valid as higher
levels of mastery are achieved.

In discussing the influence of language on the concept of
attainment, Klausmeier et al contend that acquiring and
remembering the name of a concept may occur at any of the
four levels. However, they suggest that the younger the
child is upon attainment, the less likely he is to be
capable of providing this name. Only upon reaching the
highest level is the name of the concept considered to be
essential. Nevertheless, Klausmeier et al (1974) contend
that language may facilitate development at any level, for:

> Having the labels of concepts enables
> the individual to think in symbols
> rather than in images and to attain
> other concepts through language
> experience in the absence of
> perceptible instances. (p. 21)

Despite the variation among theoretical positions, research within the area of concept formation has produced a sufficient fund of knowledge to make possible a general statement of principles. Such a summary is presented by Vinacke (1954) as follows:

> "1. increasing age (signifying accumulation of experience) is the single most important variable in concept formation.
>
> 2. Progress in learning concepts is a continuous and cumulative affair, rather than occurring in distinct phases.
>
> 3. Earlier concept learning provides a prepara_ tion for later development.
>
> 4. Among the most important specific changes which take place with increasing age are the following:
>
>   a. Progression from simple to complex concepts.
>
>   b. Progression from diffuse to differentiated concepts.
>
>   c. Progression from egocentric to more objective concepts.
>
>   d. Progression from concrete to abstract concepts.
>
>   e. Progression from variable to more stable concepts.
>
>   f. Progression from inconsistent to more consistent and accurate concepts.
>
> 5. Concept formation involves processes which cannot be inferred from either mental age or vocabulary."

(Vinacke, 1954, pp. 532_533)

Rather than inferring that developmental changes are essentially the same for all children, however, Vinacke (1959) suggests the following:

> It is closer to the truth to define continuing processes, rather than separate stages, and to recognize sufficiently variations among children. The learning of children is a matter of continuously unfolding abilities within wide ranges of potential. (p. 529)

V. COGNITIVE STYLE

Variation in conceptual development has also been explored through the investigation of psychological processes represented in categorization and conceptualization styles. The construct of cognitive style, as defined by Kagan, Moss and Sigel (1963) refers to "stable individual preferences in mode of perceptual organization and conceptual categorization of the external environment. (p. 74)

Several studies (Clayton and Jackson, 1961; Gardner, 1953; Sloane, 1959) have suggested that individuals vary consistently in the degree of differentiation imposed upon objects and events when categorization is required. Such consistencies have been demonstrated to persist over time, and appear to be largely independent of the level of abstraction at which categorization occurs. (Gardner et al, 1962)

Originally, Gardner (1953) described these individual consistencies as "a dimension of equivalence range dispositions". Thus he postulated that subjects who divided a

heterogeneous array of objects into numerous groups were persons high in conceptual differentiation (and having a narrow equivalence range). Those who categorized in terms of few groups were accordingly attributed with having a wide equivalence range. In further studies, however, Gardner revised his conception of the equivalence range dimension, extending its inclusion to a larger group of cognitive control principles. Such a revision is in keeping with his statement (1962) that:

> (t)he obvious conclusion to be drawn
> .. is that concept formation and the
> cognitive control principles involved
> in the individual's style of concept
> formation are more complex than has
> ordinarily been assumed. (p. 2)

The processes underlying individual response tendencies have been extensively investigated by Kagan, Moss and Sigel (1963). Initial experiments involved the presentation of a series of stimulus arrays of human figures to a group of adult subjects. Individual subjects were requested to indicate the figures which they considered to belong together. The selected groups were then classified as representing one of two basic orientations (egocentric or stimulus-centred).

The basis of organization employed was then analyzed according to previously determined criteria. Responses designated within the analytic-descriptive category referred to those groupings based on similarities in objective elements which were an observable part of the total stimuli. The inferential-categorical class referred to groupings where some inference about the stimuli grouped

together was assumed. The relational category referred to groupings based on a functional relationship between or among the stimuli involved.

Upon analysis of their findings with adults, individual assessments of several personality variables were made and correlated with the conceptual preferences revealed by the sorting task. Tentative conclusions suggested that "an analytic attitude may influence the quality of many kinds of cognitive products". (p. 79)

In an attempt to investigate the development of an analytic attitude, Kagan, Moss and Sigel modified their instrument for use with children. A set of thirty cards, each containing three black and white drawings, was subse-quently developed. For each stimulus, the subject was requested to select those two that were alike or went together in some way. Their studies, as well as those conducted independently (Chiu, 1972; Sigel, 1967; Gray and Knief, 1975) have indicated a general increase in the incidence of analytic responses as a function of grade level. The preferred response or individual cognitive style revealed by their measures has also been demonstrated to be moderately stable over time.

Throughout the investigations of Kagan and his assoc-iates, one may infer a preference for an analytic style or attitude. Responses designated as relational are considered to represent a passive reaction to the stimuli, thus in-volving low-order thinking. Analytic responses, however,

are considered indicative of a more reflective approach wherein stimuli are actively differentiated.

Strong disagreement with this interpretation, however, is expressed by Wallach and Kogan (1965). In discussing the meaning of the relational mode they contend:

> While relational responses might have such meaning in the case where themas are obvious, it seemed reasonable that relational responding on an object-sorting task might have much in common with creativity, since such responding would represent a free-wheeling, non-conventional approach in the face of instructions encouraging abstraction. (p. 141)

Accordingly, they attempted to investigate the links between categorization behavior, intelligence and creativity.

Within their examinations, Wallach and Kogan (1965) obtained measures of categorization breadth (using an adaptation of the Pettigrew category width test and a modified form of the Gardner object-sorting test), conceptualization (as analyzed by the criteria employed by the Kagan group) and thematic integration (considered to be another aspect of conceptual style). Results indicated a relationship between broad category width and a high degree of creativity (as measured by the thematic integration task), particularly in the case of female subjects. A less direct relationship between conceptual style and intelligence or creativity was evident. With male subjects, the bulk of responses designated relational was supplied by subjects either high or low in both intelligence and creativity.

However, this mode of response was infrequently employed
by boys high in intelligence but low in creativity. This
particular group of subjects was characterized by an in-
ferential conceptual style. As a result of these findings,
Wallach and Kogan (1965) conclude:

> .. it is quite evident that categorizing
> and conceptualizing activities have
> much to do with creativity and intelli-
> gence. ... Clearly the time is now
> ripe for the creativity-intelligence
> issue to assume its proper perspective
> within the domain of the cognitive
> processes. (p. 142)

Lundsteen and Michael (1966) and later Lundsteen (1974)
elected to explore the relationship between stimulus mater-
ial and cognitive style. In both studies, identification
of 'dominant preference' was based upon the stated criteria:
"an incidence of at least forty percent of answers within
a particular category and at least ten percent less in any
other category". (1974 p. 271) Categories of style were
designated as abstract, functional or concrete. Individual
choices of meaning were analyzed accordingly. Although
evidence of development along a concrete to abstract dimen-
sion (as revealed by preferred choice) was indicated, the
complexity of stimulus material utilized was also revealed
as a variable affecting cognitive preference.

As indicated by the diverse research methods and find-
ings which have been discussed, the complexity of the
process of concept development becomes apparent. In seeking
a fuller understanding of the process, we may be guided by

the words of Gardner and Schoen (1962):

> human concept formation will be
> adequately understood only when
> effective laws are formulated for
> both the general phenomena of
> concept formation and the organ_
> ization of relevant cognitive
> structures in the individual. (p. 1)

VI. SUMMARY

This chapter has reviewed the literature and research
relevant to an investigation of classification strategies
employed by children.

Despite the diversity of opinion expressed herein as
to the extent and nature of the relationship between lang_
uage and conceptual activity, it is generally conceded
that a relationship does exist. Upon examination of the
various coding systems represented through languages,
cultural differences in both knowledge and experience are
apparent. This is not to suggest that one language is
superior to another, but rather to emphasize the function
of language and its subsequent influence upon cognitive
processes. Each symbolic system known to man serves equally
well within its context in allowing the sharing of relevant
thoughts, ideas and desires. As Orr and Cappannari (1967)
state:

> the spoken word is the external aspect
> of the internal dream and symbol. (p. 63)

Words and their meanings are connected to experience
through mediation by our nervous systems. These connections,
are arbitrary. Word meanings are learned, they do not

instinctively occur. As the child gains a greater degree of direct and 'language' experience, what he means by a word may change accordingly. In determining the level or stage of development attained, however, indirect means of assessment must of necessity be employed. Recent research. ers have sought an understanding of the underlying processes of word meaning. Although verbal responses continue to provide the most accessible means of vocabulary assessment, reliance upon measures thus obtained may be inadequate.

The crucial test of the attachment of meaning lies in the ability to identify new instances of what is named. Words, however, seldom name particular things but rather represent classes or categories of meaning. The capacity for classification thus facilitates the storage and retrieval of necessary information within the human brain. Theories concerning the process of classification have generally adopted a developmental perspective since increasing discriminative abilities among children are readily apparent. Individual variations in ability have been extensively investigated, with a consensus that deve. lopmental trends and preferred strategies of classification may well affect the resulting cognitive product.

Investigations as to the nature and development of concepts have also been numerous and varied. The complex. ity of the process involved becomes apparent upon examina. tion of the divergent theoretical approaches which have been put forward. A lack of agreement persists not only

as to how concepts are formed, but also as to how and when

they should be taught. If learning experiences are to be

designed so as to enhance concept development, a more com_

prehensive means of diagnosis would prove invaluable. As

suggested by Russell (1956):

> When vocabulary tests develop more as
> tests of depth, breadth, precision,
> and application, they should come
> still closer to being tests of concepts
> understood by the child. (p. 124)

Individual variations in conceptual development have

recently been attributed to various aspects of cognitive

style. Subsequent studies have explored response tendencies

and investigated their possible determinants. Although

reported findings may be open to interpretation, such

research contributes to our understanding of individual

differences. If our educative goal is to assist each

student to reach his or her full cognitive potential, such

an understanding must be considered imperative.

CHAPTER 3

DESIGN OF THE STUDY

Within this chapter the design of the study is reviewed.
Procedures for the selection of the sample are outlined.
The Pilot Study (which was conducted prior to data collec-
tion) is described, and subsequent procedural modifications
outlined. A rationale and description of the instruments
selected for use in the study is then presented. A
description of the methods employed in the collection of
data follows, and the chapter concludes with a description
of the methods employed in the classification of responses
and subsequent analysis of the data.

I. SELECTION OF THE SAMPLE

The sample for this study was selected from a grade
five classroom of one school within the Edmonton Public
School System. Because of the small school population, the
single grade five classroom was heterogeneous in composition
(i.e. children of all ability levels were represented). In
addition, since only one classroom teacher was involved,
the bias arising from teacher effect could be reduced
considerably. The community served by the school was
somewhat atypical with regard to socioeconomic status.
According to information obtained from the school principal
a wide range of SES (from low to high) was represented
within the school population. Thus the sample was

considered to be typical of a cross-section of grade five students in Edmonton.

From the selected classroom, children within the age range of eleven years plus or minus four months were determined. In addition to the age criterion, the sample was controlled by excluding students with known hearing or vision problems, students with English as a second language, and students with known learning problems. As equal number of males and females was represented among the twenty children meeting the selection criteria.

Selection of this particular age group was based upon Piaget's formulation of stages of cognitive development. Children between the ages of seven and eleven are generally considered to be at a concrete operational level during which time the ability to classify becomes operative. At a later age (or stage), the period of formal operations is marked by an extension of cognitive abilities. Thus children within the age range selected for this study were assumed to be operating at a concrete operational level, with some transition into the formal operational level likely occurring.

Although intelligence was not employed as a selection factor, the most recent IQ scores available for each of the twenty selected subjects were collected from the cumulative record cards. Standardized vocabulary test scores on the Stanford Achievement Test were also made available following the collection of data.

II. PILOT STUDY

A pilot study was conducted in April of 1977. Four students (two males and two females) meeting the selection criteria were randomly chosen from the population of a large elementary school. All students were individually interviewed and presented with two tasks consecutively. Order of presentation of the tasks was alternated between subjects.

Task One consisted of an adaptation of the Sigel Cognitive Style Test. Individual responses were tape-recorded and then transcribed. All subjects responded to each set of pictures and were able to provide verbal explanations for their choices. Following the presentation, each subject was interviewed as to the task itself. All indicated that the pictures were easily identified and that the directions were clear.

Task Two required the sorting, labelling and explanation for grouping of a series of items. A combination of objects, picture cards and word cards was employed (five of each). Although three levels of 'abstraction' were represented within the stimulus materials, none of the subjects appeared to differentiate between them (by separating the three levels into distinct groups). The inclusion of the picture cards was found to be somewhat limiting since the objects depicted tended to be literally interpreted. For example, a picture of a watch would not

be employed as an action word represented by the same name (whereas it was felt that a multiple meaning might be sti_mulated by a word alone). Consequently, this second task was replaced by the Coull Word Sort Task which was develop_ed by the investigator.

In addition to this task revision, the pilot study helped to clarify procedures to be utilized. Instructions were standardized and an average time allotment of thirty minutes per student per task was determined. A decision was also made to separate the tasks (present them in two separate testing periods) so as to enhance the level of concentration.

III. INSTRUMENTATION

Rationale

Since the major purpose of the present study was to explore and describe the process of classification, an in_direct means of observation was necessarily employed. By observing the modes of perceptual organization selected, and eliciting a verbal label or explanation for each classification instance, some insight into the conceptual processes which might be operating was sought.

Although perceptual and conceptual processes have traditionally been considered to be separate and somewhat distinct, their interrelationship has recently been explored through various investigations concerned with cognitive strategies or styles. Research within this area has primarily sought to provide some explanation for the wide

range of individual differences in cognitive product which
are readily observable among children of similar age and
intelligence. Despite the various interpretations which
have been proposed, the construct of cognitive style has
generally referred to "a self-consistent mode of behavior
in which an individual approaches cognitive demands".
(Yu, 1977, p. 25)

Evidence of consistent individual variation or style
in both perceptual and conceptual processing behavior is
readily available, yet the extent and nature of the relation-
ship between the two processes continues to be debated.
Bruner (1956) goes so far as to contend that "perception
involves an act of categorization" (p. 7), thus inferring
that similar (though not identical) processes of inference
are applied in both perceptual and conceptual activities.
For the purposes of the present study, the conclusions of
Turner (1975) are adopted with regard to this debate:

> (I)t is thus appropriate to consider
> perceptual development as a necessary
> component in the understanding of
> cognitive development. A person's
> thinking is influenced by his perception
> and what he perceives is to a greater
> or lesser extent influenced by what
> he thinks. (p. 48)

In their analysis of individual differences in the
processing of information, Kagan et al (1963) identified
and described three distinctive styles of conceptual
classification (descriptive, relational-contextual and
categorical-inferential). Evidence of a particular style

was inferred from an analysis of grouping responses on a test designed for their study. Since general behavioral tendencies in the analysis and differentiation of external stimuli have been validated by use of this instrument (Kagan et al 1964; Chiu, 1972), an adaptation of their methods was employed in this study.

As a means of exploring individual strategies in a less structured situation requiring the classification of words rather than pictures, the Coull Word Sort Task was subsequently developed. Since the array of words selected could be sorted in numerous ways, it was intended that the categories to be utilized would be generated by each subject. As suggested by Wallach and Kogan (1965) such an approach might be termed a 'category_search operation':

> Essentially, subjects must decide how
> narrow or broad a range of objects can
> be justifiably grouped together as
> "equivalent" in some respect. Breadth
> of categorization, in other words, is
> reflected in the number of grouping
> used in fulfilling the task
> requirements. (p. 97)

Thus by combining the information revealed by these two measures, it was intended that a basis for the description of both inter_and intra_child differences in task performance be established. A more specific description of the tasks is presented in the following.

Task One: Sigel Cognitive Style Test

The Sigel Cognitive Style Test (henceforth referred to as the SCST) is an adaptation of the conceptual style

test for children which was developed by Kagan, Moss and Sigel in 1963. Originally consisting of forty-four items, the test was later revised to include thirty items. (As a result of this revision, it was claimed by the authors that the least discriminating items had been eliminated). Using this revised test form, the corrected split-half reliability coefficient in one study conducted by the authors was reported as .94 (recorded in Johnson and Bommarito, 1971).

Stimuli included in the test were designed to elicit specific types of conceptual categorization. Descriptive-analytic responses are defined as "pairings based on a verbalized similarity in observable attributes of the stimuli". Relational-contextual responses are those based on a functional or thematic relationship between two stimuli. Categorical-inferential responses include pairings based on a similarity in inferred qualities or attributes or involve a language convention.

A similar basis for categorization of responses was employed by Sigel (1967) in his adapted test form, but various sub-classes for each type of response were identified and illustrated. Items included in the SCST originally numbered thirty-five, but are currently in the process of revision by Sigel.

In the present study, a set of fourteen picture sets which had been revised by Yu (1977) for use in an ongoing study were employed. The stimuli were standardized so that

all pictures were in the form of black_and_white drawings.
(Sigel's original picture set contained a mixture of photo_
graphs and drawings). In addition, repetition of pictures
in the revised form by Yu were completely eliminated, thus
controlling for any possible interference created by the
appearance of a picture within one set which had previously
been part of another. All pictures within the remaining
sets had previously been validated by Yu in her investi_
gations as to identity and familiarity of the objects
depicted.

In this adapted form of the SCST (as in all previous
forms of the test), each set of stimuli contained a triad
of pictures representing various combinations of people
and familiar objects. Subjects were requested to pick
out the pictures that were alike or went together in some
way, then state the basis for grouping in each instance.

A further modification of the original instrument
involved performance time. In Sigel's investigations, a
time limitation of 75 seconds for each triad of pictures
was employed. In the present study, it was considered
that a time limitations might restrict the number or type
of responses given. Accordingly, no time limitations were
imposed. For purposes of exploring the time factor,
however, beginning and ending times were recorded for each
performance.

Task Two: Coull Word Sort Task

The Coull Word Sort Task (henceforth referred to as the CWST) was developed by the investigator as a means of observing both the classification processes employed and flexibility of strategies available to children within the sample. Twenty-two nouns delineating familiar objects were selected for inclusion. A list of the words employed is presented below:

(1) typewriter   (2) radio   (3) telephone

(4) rocket   (5) furnace   (6) raft

(7) wheelchair   (8) truck   (9) sailboat

(10) kite   (11) skidoo   (12) ship

(13) train   (14) skateboard   (15) crutches

(16) airplane   (17) bicycle   (18) car

(19) tractor   (20) baby buggy   (21) skates

(22) dryer

Following the selection of stimuli to be employed, possible bases for grouping or classifying were validated using two experts familiar with the behavior of children at the selected age level. Several possible means of classification were determined. (See Appendix A) This led the investigator to conclude that ample scope for variable classification was present within the set of stimuli.

Selected words were printed on individual cards, and the level of difficulty assessed using two subjects meeting the age criterion. All stimuli were determined to be readily

recognized. Task performance by these subjects indicated a range in number of groups produced as well as variability in the bases for classification of the stimuli.

Stanford Achievement Test in Reading

The Stanford Achievement Test (SAT) is a standardized reading test published by Harcourt, Brace and World Inc., New York. Since its original publication in 1923, it has undergone four revisions.

The Intermediate II form of the test is designed to be used with pupils from the middle of grade 5 to the end of grade 6. Two separate tests, Word Meaning and Paragraph Meaning, are included. Within the accompanying testing manual, the following uses of test results are suggested:

"1. to provide an objective measure of the achievement level of each pupil, to be used as a basis for planning individualized instruction.

2. to compare present and past achievement in order to determine and evaluate the rate of progress.

3. to obtain data on the range of ability.

4. to provide information to be used in grouping the pupils in a class for instructional purposes.

5. to provide a basis for reporting pupils' achievement to parents.

6. to aid in the evaluation of each pupil's achieve_ ment in the light of age, mental ability, and other factors".
(SAT, Directions for Administering, p. 10)

Reliability data for the Intermediate II Reading Tests are also provided in the test manual. Corrected split_half reliability coefficients of .89 and .93 are supplied for

the Word Meaning and Paragraph Meaning tests respectively.
With regard to validity, the manual suggests that it "is
best thought of as the extent to which the content of the
test constitutes a representative sample of the skills and
knowledges which are the goals of instruction". (p. 11)

IV. COLLECTION OF THE DATA

Prior to the individual interviews, a classroom visit
was conducted during which time the interviewer was intro-
duced to the class. An explanation of the purpose and
general procedures of the study was provided to the entire
group. Assurance was given that this was not a test for
report card purposes. (Because of the time of year, this
appeared to be a possible source of anxiety). Students were
also assured there were no right or wrong answers, that what
they personally thought was the type of information sought.

A few days later, the series of individual interviews
was begun in a separate room at the school. The interview-
ing period extended from May 2 to May 12, 1977 with normal
school hours and breaks being observed. To control for the
possible interference of order of presentation, those stu-
dents meeting the selection criteria were randomly assigned
to one of two groups (each containing ten subjects). Group
One was given the Sigel Test first, and the procedure was
reversed for Group Two, who began with the Word Sort Task.
For all subjects, a minimum of one-half day elapsed between
presentation of the two tasks.

Procedure during the Sigel Test was standardized, beginning with oral instructions (see Appendix B) and an explanation of the presence of the tape recorder. All picture sets were displayed on individual pages of a ringed binder which was placed on a table top facing the subject. An invitation was extended to simply turn the page when a set was 'completed' (although some subjects indicated verbally that they were done or waited for the page to be turned for them). Individual responses were tape-recorded and simultaneously noted by use of a prepared record sheet. Anecdotal observations of non-verbal behavior (gestures, facial expressions, eye contact etc.) were also recorded. Following each interview, a verbatim transcription of responses was made within forty-eight hours of the recording. At this time as well, anecdotal observations were clarified or expanded as necessary.

Throughout the testing situation, probing as to reasons for the grouping was used when such information was not volunteered. The form of the probe was a question such as "how do those two go together?" or "could you tell me how they belong together?". Similarly, when a single pair was selected for a particular set of pictures (usually followed by a long pause), an attempt to determine whether or not the set was completed was made by inquiring "anything else?"

Although no time limitations were set, beginning and ending times were noted for each performance. Since Sigel (1967) restricted the time allowed per set of pictures to

75 seconds, the effects of this limitation on responses produced was checked by analysis of each tape. Only one response for a single child was found to be incomplete during a period of 75 seconds, and the degree of discrepancy was 5 seconds containing "and ... uh ... (pause) ... that's all". Therefore, the time factor was considered to be insignificant as to the quantity of responses.

Procedure for the Coull Word Sort Task also included standardized oral instructions (see Appendix C). The twenty-two words were printed on plasticized 2" by 4" cards. These were shuffled before each interview and presented to the subject in the form of a deck. Four large sheets of paper, each divided into six boxes, were available along with a choice of writing instruments.

Invitations to regroup the cards were continued until the subject verbally indicated or responded that he had finished. After the second sort had been completed, a suggestion was made that the entire set of cards might be displayed on the table top and looked over (if this pro- cedure had not been spontaneously utilized). Similarly, after several groups had been recorded by the subject, an offer was made by the interviewer that the remaining groups might be dictated. Although no time limits were set, two subjects were "cut-off" after forty minutes since evidence of fatigue was observable in task performance.

Following the designation of stimuli which belonged together, subjects were requested to provide a title for

each group. By such means, it was deemed possible to deter-
mine the method of organization employed in the formulation
of each group. In addition, the necessity for verbal
explanation would restrict random combinations of words.

Following each interview, individual records were
consolidated and anecdotal observations which had been
briefly made during the task were expanded and clarified.
A common checklist was used as a guide, but additional notes
were also recorded after the interview had been completed.

The SAT was administered by the classroom teacher early
in June, 1977 as a part of general testing procedures.
Directions for administration were followed as outlined in
the testing manual. Time limitations of twelve minutes
for the Word Meaning Test and thirty minutes for the Para-
graph Meaning Test were applied. Tests were machine scored
through the Edmonton Public School Board facilities, and
percentiles as determined for each subject were made avail-
able to the investigator. Since Word Meaning test scores
are more generally considered indicative of vocabulary
assessment than are Paragraph Meaning test scores (which
indicate general comprehension abilities), only the percen-
tile scores for this sub-test were recorded and subsequently
employed in analysis.

V. SCHEMA FOR CLASSIFICATION OF RESPONSES

Following the Pilot Study, a common method for classi-
fying the responses on both tasks was devised. The scoring
categories described by Sigel (1967) were used as the basis
for the schema, with additions and revision of categories
as deemed necessary from the responses made available by
the Pilot Study.

The three major categories or style dimensions employed
by Kagan et al (1963) and Sigel (1967) were adopted as
defined. An additional miscellaneous category was included
to account for those responses which did not fit into the
three general categories (Descriptive, Relational_Contextual
or Categorical_Inferential). Within this new category,
responses based upon enumeration, those in which no expla-
nation was provided, or those based upon contrast were
included.

Order of the two descriptive sub_classes (part_whole
and global) used by Sigel was reversed, since global
descriptions are generally considered to be indicative of
a lesser degree of differentiation than is indicated by a
description based upon an analysis of parts.

Although no hierarchical structure is intended by
Sigel in his scoring categories, it appears that the revised
schema developed by the present investigator does imply a
general progression of conceptual complexity. This is not
to say that the sub_group defined as C_5 (see below)

represents the highest attainable order of classification, but rather a greater degree of abstraction is reflected as one reads through the schema.

The following is an outline of the revised schema which was used for the classification of responses for both tasks in the study. Definitions for the Descriptive, Relational_Contextual, and Categorical_Inferential categories are taken from Sigel's SCST Manual (1967). Sub_groups were determined and examples provided by the present investigator.

MISCELLANEOUS RESPONSES

Those responses where the basis of selection is not specifically stated. Sub_groups include:

E Sorts in which a description of characteristics is given on an individual basis or as a chained response. No specific basis for similarity between the objects is included.
  Example: this one is red and this one is blue.

N Sorts in which no reason for grouping is provided.
  Example: these two just belong together.

DESCRIPTIVE RESPONSES (Stimulus Centered)

Concepts which are derived directly from the physical attributes of the stimulus and ones in which the conceptual label contains a direct reference to some physical attribute present and observable in the stimulus. Sub_groups include:

Descriptive_Global Groupings

D_1 Sorts in which the total objective manifestations of the stimuli are the basis of similarity.
  Example: they are both small, both the same shape etc.

D-2 Sorts in which one of the sexes is grouped.
   Example: they are both ladies, boys etc.

D-3 Sorts in which discrete age categories are employed.
   Example: they are both children, adults etc.

Descriptive-Analytic Groupings

D-4 Sorts in which observable parts or components are the
   basis of similarity.
   Example: they both have 2 legs, 4 wheels, the same color
   hair, same clothing etc.

D-5 Sorts based upon similarity of structural material.
   Example: both are made of wood.

RELATIONAL - CONTEXTUAL RESPONSES

Concepts which are used to tie together or relate two

or more people, objects, events or ideas. In this category

no stimulus is an independent instance of the concept; each

stimulus selected gets its meaning or definition from a

relationship with other stimuli.

Sub-groups include:

R-1 Sorts which are based on themes, plots or stories where
   no specific category is used; sort implies interaction.
   Example: he might have killed this man, she is giving
   him food etc.

R-2 Sorts in which the instances are related in space
   (geographic location, domicile) or time.
   Example: they both swim in water, are found in the
   kitchen, are used in winter etc.

R-3 Sorts in which the stimuli are associated on the basis
   of a common action or behavior.
   Example: they both move fast, both lay eggs etc.

R-4 Sorts based on a comparison of the stimulus objects.
   Example: these two are smaller than that one.

R-5 Sorts based upon an understood relationship or inter-
   dependence between the elements in a grouping.
   Example: they could be mother and son, the ruler could
   belong to the man, the horse pulls the wagon etc.

CATEGORICAL _ INFERENTIAL

A group of objects is put together where each instance in the sort is representative of the total class. Each instance is not interdependent. Characteristics are not necessarily observable. A class label is used or an inference is made. Sub_groups include:

C_1 Sorts in which the objects are grouped on the basis of a common function, use, or action upon them.
Example: You can sit on them, they all work for a living etc.

C_2 Sorts in which objects or figures are grouped on the basis of an inherent or inferred common class.
Example: They are both means of transportation, maids, etc.

C_3 Sorts in which figures or objects are grouped on the basis of an inferred quality or attribute.
Example: they are both juicy, young, have seeds etc.

C_4 Sorts in which figures are grouped on the basis of a common affect state.
Example: they are both sad, feeling angry etc.

C_5 Sorts in which a value judgment is made which evaluates something as to its intrinsic worth or purpose.
Example: these things are important for men, are useful things etc.

Examples of verbatim responses classified according to this schema are contained in Appendix D.

VI. RELIABILITY OF THE SCHEMA FOR CLASSIFYING RESPONSES

The reliability of the investigator's analysis of the S's responses was established by two independent judges. A representative sample of the responses (10%) was analyzed following a familiarization session with the investigator. During this session, the schema to be employed was explained and examples for each type of response were provided and discussed. Each judge was supplied with a written set of criteria for classification of the responses.

Inter-scorer agreements between the investigator and the two judges was calculated on the basis of the Arrington formula (1930):

$$\frac{2 \text{ x agreements}}{2 \text{ x agreements + disagreements}}$$

The percentages of agreement for the Sigel test were 96.6% and 97.4%, for the word sort task 93.4% and 95.0%. These percentages indicate that the reliability of the scoring may be considered satisfactory.

In the few instances where there was disagreement, the judges and the investigator discussed the criteria as exemplified and their application to the responses in question. As a result of these discussions, a decision was made to include a third sub-class under the miscellaneous category. This sub-class to be designated CON was defined as following:

CON - Sorts in which a contrast between objects
is identified. Rather than providing a
basis for grouping, differences between

the stimuli are described.

Example: this is an animal but that's a person.

As revealed by the discussion, some responses of this type
had been included in the Relational_Contextual sub_group
designated R_4. The consensus was that some differentia_
tion between groupings made on the basis of comparison or
contrast was necessary, since the former implied an
identification of similarities while the latter failed to
provide a basis for putting objects together. Accordingly,
all responses were re_classified on the basis of this
distinction.

VII. TREATMENT OF THE DATA

To discover the nature of classification strategies
employed by eleven_year old children, verbal explanations
of performance on two distinct tasks were classified
according to a common schema. Characteristics of individual
responses were described, and the proportion of responses
per subject within each of four categories appropriately
determined.

The measures of preference employed was adopted from
the work of Lundsteen and Michael (1974). Accordingly,
dominant preference was defined as "an incidence of at
least forty percent of answers within a particular category
and at least ten percent less in any other category".
(p. 271) Using this criterion, the incidence of dominant
preference revealed by task performance was determined.

To determine the degree of flexibility within classi_
fication strategies, a Multiple Classification Index was
devised. Upon analysis of task performance on the Coull
Word Sort Task, individual Multiple Classification Indices
were determined.

Using the measures thus obtained, as well as the per_
centiles available for the Stanford Achievement vocabulary
sub_test, statistical correlation coefficients were deter_
mined. The computer services of the Division of Educational
Research Services of the University of Alberta Faculty of
Education were employed in this regard.

As previously stated, individual anecdotal observations
were made throughout performances on the two tasks.
Information thus obtained was compared subjectively with
that revealed by the Multiple Classification Indices to
determine whether or not observable behavioral differences
might be related to flexibility of categorization.

To examine any possible differences in performance
between boys and girls, a series of t_tests were calculated.
Relationships between the number of responses produced,
time required for task completion, and proportionate
responses within each classification category were explored.

CHAPTER 4

ANALYSIS AND INTERPRETATIONS OF THE FINDINGS

Within this chapter the findings of the study are presented and interpreted. Characteristics of pupil respon- ses as revealed in the performances of two separate tasks are described. Results of analyses of proportionate respon- ses within each of four categories are presented and discussed. The incidence of dominant preference as revealed by task performances is reported and compared with findings obtained in previous studies. A discussion of flexibility in categorization strategies follows, with variations in equivalence range identified as potential determinants of individual differences in categorization behavior. A ration- ale for and description of the Multiple Classification Index developed for this study is provided. Results of a compari- son of performance revealed by this measure with that indicated by percentile scores on a standardized achievement test are presented and discussed. Differences in performances of boys and girls (analyzed by means of t_tests) are interpreted. The chapter concludes with a summary of the findings.

I CHARACTERISTICS OF PUPIL RESPONSES

Task One: Sigel Cognitive Style Test (SCST)

Fourteen sets of three pictures were individually presented to each subject who was requested to designate pairs or groups that belonged together. All responses were

recorded and transcribed. The number of responses by an individual subject ranged from 18 to 84, with an average response total for the group of 33.65. Although no time limitations were set, beginning and completion times were recorded. Time required for the completion of the task ranged from 5 to 14 minutes, with a mean time of 9.65 minutes for the group.

Using the previously described scheme, all individual responses were analyzed as to category. The proportions of responses within each category to the total responses provided by each subject were determined. Results of this analysis are shown in Table 1.

Proportionate responses for each of the twenty subjects are indicated under each of the four category headings. (Table 1) Thus these proportions when added by row represent 100% of the responses provided by a particular subject. Bracketed numbers indicate the actual number of responses within each category.

The criterion for dominant preference employed in this study was previously defined as "an incidence of at least forty percent of answers within a particular category and at least ten percent less in any other category". Dominant preference as revealed by performance on this task was determined accordingly for each subject. This preference is indicated in the extreme right column of Table 1.

TABLE 1

PROPORTION OF RESPONSES PER CATEGORY ON

THE SIGEL COGNITIVE STYLE TEST

Subject	Miscellaneous	Descriptive	Relational-Contextual	Categorical-Inferential	Total Responses	Dominant Preference
1	(2)[a] .067[b]	(7) .233	(13) .433	(8) .267	30	R-C
2	(1) .030	(12) .364	(15) .455	(5) .152	33	*
3	(27) .329	(17) .207	(25) .305	(13) .159	82	*
4	(1) .037	(9) .333	(8) .296	(9) .333	27	*
5	(0)	(6) .261	(13) .565	(4) .174	23	R-C
6	(0)	(18) .429	(11) .262	(13) .310	42	D
7	(2) .061	(11) .333	(10) .303	(10) .303	33	*
8	(0)	(10) .417	(7) .292	(7) .292	24	D
9	(1) .05	(8) .40	(4) .20	(7) .35	20	*
10	(5) .109	(10) .217	(18) .391	(13) .283	46	*
11	(0)	(7) .368	(8) .421	(14) .211	19	*
12	(0)	(3) .125	(14) .583	(7) .292	24	R-C

TABLE 1 (continued)

PROPORTION OF RESPONSES PER CATEGORY ON

THE SIGEL COGNITIVE STYLE TEST

Subject	Miscellaneous	Descriptive	Relational Contextual	Categorical Inferential	Total Responses	Dominant Preference
13	(0)	(7) .25	(11) .393	(10) .357	28	*
14	(1) .056	(3) .167	(13) .722	(1) .056	18	R_C
15	(1) .018	(19) .339	(11) .196	(25) .446	56	C_I
16	(0)	(9) .375	(8) .333	(7) .292	24	*
17	(6) .130	(12) .261	(14) .304	(14) .304	46	*
18	(2) .08	(7) .28	(12) .48	(4) .16	25	R_C
19	(0)	(15) .357	(14) .333	(13) .309	42	*
20	(1) .032	(15) .484	(11) .355	(4) .129	31	D

a Actual number of responses provided

b Number of responses within category ÷ total number of responses

* No dominant preference (according to criterion employed)

As indicated by Table 1, individual responses on the
SCST varied considerably as to the categories of responses
employed. Proportions within a single category ranged from
0% to 72% of total responses for an individual.

Incidence of dominant preference, however, was less
clearly indicated. According to the criterion employed,
55% of the subjects revealed no dominant preference.

Task Two: Coull Word Sort Task (CWST).

Twenty-two word cards were individually presented to
each subject who was requested to sort the words into as
many groups as possible. The composition of each group and
the explanation or title provided was recorded. The number
of groups formulated by an individual subject ranged from
8 to 33, with a mean of 15.6 for the total sample. Since
each of the word cards could be used more than once, the
total number of words classified was also available. This
number ranged from 27 to 299, with a mean of 76.35 words
classified.

Using the same classification schema that was employed
for analysis of task one performance, all responses on this
task were analyzed as to category. Proportions of responses
within each category to the total number of reasons or titles
provided for the groups were determined. Results of this
analysis are shown in Table 2.

TABLE 2

PROPORTION OF RESPONSES PER CATEGORY ON

THE COULL WORD SORT TASK

Subject	Miscellaneous	Descriptive	Relational-Conceptual	Categorical-Inferential	Total Groups	Dominant Preferences
1	(2)[a] .118[b]	(1) .059	(9) .529	(5) .294	17	R_C
2	(0)	(6) .30	(8) .40	(6) .30	20	*
3	(0)	(1) .067	(6) .40	(8) .533	15	C_I
4	(0)	(0)	(2) .25	(6) .75	8	C_I
5	(0)	(4) .182	(6) .273	(12) .545	22	C_I
6	(0)	(0)	(3) .375	(5) .625	8	C_I
7	(0)	(0)	(2) .333	(4) .667	6	C_I
8	(0)	(0)	(9) .529	(8) .471	17	,*
9	(2) .125	(1) .063	(9) .563	(4) .25	16	R_C
10	(0)	(2) .105	(2) .105	(15) .789	19	C_I
11	(0)	(1) .083	(2) .167	(9) .75	12	C_I
12	(0)	(1) .071	(7) .50	(6) .429	14	*

TABLE 2 (continued)

PROPORTION OF RESPONSES PER CATEGORY ON

THE COULL WORD SORT TASK

Subject	Miscellaneous	Descriptive	Relational-Conceptual	Categorical-Inferential	Total Groups	Dominant Preferences
13	(0)	(12) .364	(3) .09	(18) .545	33	C_I
14	(0)	(0)	(5) .357	(9) .643	14	C_I
15	(0)	(0)	(8) .571	(6) .429	14	R_C
16	(0)	(1) .111	(4) .444	(4) .444	9	*
17	(0)	(1) .052	(7) .368	(11) .579	19	C_I
18	(0)	(1) .05	(4) .20	(15) .75	20	C_I
19	(0)	(1) .059	(8) .471	(8) .471	17	*
20	(0)	(2) .20	(4) .40	(4) .40	10	*

a Actual number of groups formulated

b Number of groups per category ÷ total number of groups

* No dominant preference (according to criterion employed).

As indicated by Table 2, individual responses on the CWST also varied considerably. Proportions within a single category ranged from 0% to 79% of total responses for an individual.

Incidence of dominant preference was also seen to vary within this task as compared to performance on the SCST. Using an identical criterion of analysis, 55% of the subjects revealed a preference for categorical-inferential responses on this task.

II DISCUSSION OF TASK PERFORMANCE
Incidence of conceptual categorizations

Using the data obtained from the analysis of individual responses, total proportions of responses within each cate- gory for the entire group of subjects (N=20) were obtained. Results of this analysis are presented in Table 3.

As indicated by Table 3, the highest proportion of responses on the SCST occurred within the relational- contextual category (.357 of total responses). This was followed by a proportion of .305 within the descriptive category, .264 within the categorical-inferential category and .074 in the miscellaneous category.

Performance on the CWST evidently varied as to the means of classification employed. The highest proportion of responses occurred within the categorical-inferential category (.525 of total responses). This was followed by a proportion of .348 within the relational-contextual

TABLE 3

PROPORTION OF RESPONSES PER CATEGORY

GROUP PERFORMANCES ON BOTH TASKS

(N=20)

SCST

Category	Number of Responses	Proportion of Responses
Miscellaneous	50	.074
Descriptive	205	.305
Relational_Contextual	240	.357
Categorical_Inferential	178	.264

CWST

Miscellaneous	4	.013
Descriptive	35	.113
Relational_Contextual	108	.348
Categorical_Inferential	163	.525

category, .113 within the descriptive category and only
.013 in the miscellaneous category.

At first glance it would appear that these findings
are contrary to those presented by the Kagan group. Their
studies have reported "a linear developmental trend from
relational to analytical conceptual styles in children
ranging from age six to twelve". (Denney, 1971, p. 142)
Thus in keeping with these general findings, one might
expect a higher proportion of descriptive responses than
were obtained in the present study.

An explanation for this apparent discrepancy may be
found in the criterion of analysis employed. In analyzing
adult performances on a figure-sorting task, Kagan et al
(1963) refer to those subjects who scored above the median
on analytic concepts as "analytic-descriptive subjects.
Nonanalytic subjects are defined as "those high in
relational concepts", but a quantitative criterion for
analysis is not included within their reports. Since no
explicit criterion is stated in their subsequent research
with children, one might infer that similar definitions
were employed.

It should also be noted that the research reported by
Kagan et al (1963) includes a clearly stated assumption
which should be considered in any interpretation of their
results:

We viewed the relational response
as requiring the least amount of
analysis of the stimulus array.
Relational concepts differ from
analytic-descriptive concepts with
respect to the part-whole analysis
of the stimulus. In a relational
concept each stimulus in the group
retains its complete identity and
is classified as a whole. In an
analytic-descriptive concept the
S selects from each stimulus a
specific subelement that is
similar to a subelement within
another stimulus. In effect, to
form a descriptive concept, S
usually separates figure (the
element of similarity) from ground
(the irrelevant aspects of the
stimulus). In a relational concept
the entire stimulus is figure, and
there are no background elements.
... Thus descriptive concepts
involve an active conceptual
analysis, while relational concepts
seem to involve a passive acceptance
of the entire stimulus. (p. 77)

Since such an assumption was not adopted within this

study, the categorization of responses may have been in-

fluenced accordingly. Furthermore, the definition of

"analytic" employed in the investigations of Kagan et al

may have been interpreted more broadly than the definition

employed in the present study (where analytic responses were

categorized as "descriptive".) This issue of interpretation

has also been raised by Gardner (1963) as expressed in his

statement:

I was troubled in reading (Kagan's)
paper by the repeated implication
that analytic responses are uniquely
"analytic", since it is clearly true
that responses called "inferential-
categorical" are equally analytic
and represent a considerably higher
level of abstraction. (p. 113)

By their own admission, the authors of the original Conceptual Style Test purposely designed stimuli that would discourage the incidence of categorical-inferential responses. Thus the lower incidence of categorical-inferential responses (as compared to relational-contextual or descriptive responses) reported in studies using their materials may well be a function of the stimuli rather than the conceptual styles or preferred strategies employed by the subjects.

Despite the inconclusiveness of present investigations relating preferred style with stimulus materials, certain conclusions regarding this relationship may be drawn. The influence of both the methods and materials of assessment may well affect any indications of conceptual style or strategy. Thus any statements regarding individual prefer-ences should at present be carefully qualified. As indicated by Kagan and Kagan (1971):

> Statements about individual differences
> in categorization strategy must contain
> a strong statement about materials
> manipulated. A child may be analytic
> with visual stimuli containing subtle
> analytic cues but superordinate with
> verbal representations of those objects.
> (p. 1308)

Findings of the present study would appear to support this point of view. The higher incidence of categorical-inferential responses revealed by performance on the Coull Word Sort Task may have been related to the abstraction level inherent in the stimuli (i.e. words) themselves. Similarly, the lower incidence of descriptive responses on the CWST may also have been related to the stimulus

materials themselves. Stimuli presented in pictorial form
may elicit a more stimulus-bound reaction (or one directly
related to the objects depicted) than would verbal stimuli.
Further investigation within this area may well contribute
to our knowledge and understanding.

Indications of dominant preference

Using the previously defined criterion, individual
subjects were classified with respect to the predominant
categories employed in performance of the two tasks.
Results of this analysis were pooled, and total proportion
of responses within each of the three categories (descriptive,
relational-contextual and categorical-inferential) were
determined as indicated in Table 4. As revealed by this
analysis, 45% of the subjects displayed some distinctive
style (according to the criterion employed) on Task One, while
72% of the subjects displayed some distinctive style on
Task Two.

TABLE 4

INCIDENCE OF DOMINANT PREFERENCE

GROUP PERFORMANCES ON BOTH TASKS

(N=20)

Task	Proportion of Dominant Preference	
SCST	Descriptive	15%
	Relational_Contextual	25%
	Categorical_Inferential	5%
	No Dominant Preference	55%
CWST	Descriptive	0%
	Relational_Contextual	15%
	Categorical_Inferential	55%
	No Dominant Preference	30%

Previous studies by Lundsteen and Michael (1966) and
Lundsteen (1974) employed identical criteria in their
analyses of dominant preference. In both studies, evidence
of an increased incidence of dominant preference was found.
In the first study (1966) only 24% of the third grade pupils
sampled exhibited a distinct preference, while a much higher
proportion of incidence was displayed by the sixth-grade
pupils sampled.

In both studies, however, the incidence of a distinct
preference was found to vary according to the nature of the
materials employed in the assessment. In Lundsteen's study
(1974) two measures reflecting the preferred qualitative
category of meaning selected by 190 children (at third and
sixth grade levels) were employed. Although the reported
incidence of dominant preference when simple material was
employed was 21% and 41% for third and sixth grade subjects
respectively, percentages of occurrence rose to 72% and 91%
when more complex material was employed. Subsequently,
Lundsteen concluded that both the level and depth of meaning
elicited at any developmental stage may well be influenced
by the stimulus material employed.

Variability in incidence of dominant preference as
revealed by performance on the tasks employed in the present
study may also be due to the nature of the stimulus materials
themselves. It is interesting to note that both the incidence
and nature of dominant preference revealed in the task
requiring processing of verbal stimuli varied considerably

from that employing pictorial stimuli. This may be due to the age of the subjects, their previous experiences or a reaction to the stimuli employed. Further investigation of these factors may be advised.

III FLEXIBILITY OF CATEGORIZATION STRATEGIES

An alternate approach to the assessment of cognitive style involves a consideration of the range of discriminable events or objects assigned to a common class. In the investigation of categorization behavior, individual differences have thus been attributed to variations in the "degree of differentiation spontaneously imposed upon heterogeneous arrays of objects" (Gardner and Schoen, 1962, p. 1). This dimension of equivalence range (alternately termed conceptual differentiation) is conceived by Gardner to be one of a larger group of cognitive control principles which are defined as:

> dimensions of individual differences
> in cognitive structures that mediate
> the expression of particular
> intentions when the person is
> confronted with particular classes of
> stimulus conditions. (in Gardner and
> Schoen, 1962, p. 2).

The dimensional principle of conceptual differentiation has been shown to be highly consistent in numerous investigations (Marrs, 1955; Sloane, 1959; Gardner and Schoen, 1962 etc.). Methods employed have generally involved a free sorting of various objects, words or pictures. In all instances, those subjects who preferred to differentiate the array of stimuli presented into a large number of categories or groups were considered to have a high level of conceptual differentiation (thus demonstrating a narrow equivalence range). Conversely, those subjects who

distinguished a smaller number of categories were considered
to have a low level of conceptual differentiation (and a
broad equivalence range).

These individual consistencies in equivalence range
have also been investigated by Holzman (1954), who advocates
an alternate method of analysis. He proposes a distinction
between 'levellers' and 'sharpeners' and subsequently defines
the tendency to sharpen as:

> a propensity to maximize stimulus
> differences _ an attunement to
> small gradients of difference
> between figure and ground. (p. 376)

Thus subjects who appear to prefer complex rather than
simple organizations are considered to be 'sharpeners'
(according to his definition). Conversely, 'levelers' are
identified as subjects who tend to minimize stimulus
differences or prefer the experience of sameness to that
of dissimilarity. Consistency in these assimilation
tendencies has been demonstrated in Holzman's investigations
using visual, auditory and kinesthetic stimulus modes.

Breadth of categorization, therefore, appears to be
reflected in the number of groups or organizations employed
within an object_sorting task. Since the Coull Word Sort
Task required each subject to generate and label the
categories to be employed (as well as to select the exemp_
lars within each group), it was assumed that some measure
of category breadth might be reflected in the number of
groups produced. Upon further examination of the data,
however, it became apparent that the number of groups

produced was influenced both by the number of sorts attempted or the method of sorting employed. Since the verbal stimuli could be used several times (depending upon the number of groups to which a particular word was considered to 'belong'), the total number of items selected and sorted was also seen to vary considerably.

Accordingly, a decision was made to devise a Multiple Classification Index (subsequently referred to as MCI) for each subject. The index represents the total number of items sorted divided by the total number of groups produced, and is considered to represent some measure of flexibility. The index, as conceived, would be influenced by the number of items sorted. Assigning a word 'membership' in various groups was considered an indication of multiple meaning, and thus of flexibility. Similarly, the index would be influenced by breadth of categorization since a small number of total groups produced could be considered to indicate a broad equivalence range (and greater flexibility as to category membership).

Results of the determination of Multiple Classification Indices are indicated in Table 5. As revealed therein, the MCI measures thus obtained ranged from 2.21 to 13.59. A considerable range in flexibility appears to be indicated as might be expected within a heterogeneous group of subjects of similar age.

TABLE 5

DETERMINATION OF MULTIPLE CLASSIFICATION INDICES

COULL WORD SORT TASK

Subject	Items Sorted	Groups Produced	MCI*
1	48	17	2.82
2	114	20	5.7
3	67	15	4.47
4	30	8	3.75
5	299	22	13.59
6	42	8	5.25
7	28	6	4.67
8	52	17	3.06
9	41	16	2.56
10	42	19	2.21
11	27	12	2.25
12	66	14	4.71
13	174	33	5.27
14	88	14	6.29
15	121	14	8.64
16	31	9	3.44
17	68	19	3.58
18	63	20	3.15
19	60	17	3.53
20	66	10	6.6

$$\bar{x} = 4.78$$

* MCI = items sorted divided by groups produced.

IV COMPARISON OF STANDARDIZED

VOCABULARY TEST SCORES WITH

MULTIPLE CLASSIFICATION INDICES

Standardized achievement test scores represent the
most common means of individual pupil assessment and sub_
sequent instructional planning employed by a classroom
teacher. Within the Edmonton Public Scholl system, the
Stanford Achievement Test in Reading (SAT) is widely
administered to grade five pupils at the end of the acade_
mic year. Thus this particular test was considered to
represent a common means of assessment which might be
employed in a typical classroom setting.

The SAT was routinely administered by the classroom
teacher to all students from which the sample was drawn.
Percentile scores thus obtained for the Word Meaning sub_
section of the test (generally considered as an assessment
of vocabulary) were compared to the Multiple Classification
Indices previously determined for each subject.

The relationship between these measures was investiga_
ted by means of statistical analysis. A Pearson Product
Moment coefficient of +.403 was calculated (df=18). This
positive correlation approaches significance, which at the
.05 level of probability would be indicated by a correlation
of .444(Ferguson, 1959, p. 315).

To further investigate the relationship between SAT
percentile scores and Multiple Classification Indices,

individual scores on the SAT were ranked from lowest to highest, thus allowing a distinction of two groups. Group One represented those subjects with percentile scores from 0 to 49, Group Two those with scores from 50 to 99. Correlations coefficients for the "low" and "high" groups were determined. A correlation of .492 was obtained for Group One, and .242 for Group Two, neither of which may be considered statistically significant. The effects of sample number (df=8), however, must be considered as a limitation in the interpretation of these results. Further investigation in this regard is warranted.

Despite the lack of statistical significance as deter-mined in the above analysis, certain trends in performance may be worthy of note. Within Group One, low SAT scores may be paired with a Multiple Classification Index below the group mean in all individual instances but one. (The 'exceptional' student in this regard tended during task performance to respond very quickly. Thus excessive speed may well have contributed to her poor performance on the SAT). Within Group Two, high SAT scores may be matched with a Multiple Classification Index above the mean for 63% of the subjects. This may indicate that a low degree of flexibility is reflected in low vocabulary achievement scores. High achievement, however, may be influenced by

flexibility but may also be related to other factors such as intelligence or creativity. Such relationships are in need of further examinations.

V FLEXIBILITY OF CATEGORIZATION
AS REFLECTED IN BEHAVIORAL
OBSERVATIONS

For comparative purposes, subjects were ranked in order of Multiple Classification Indices. Those subjects in rank order 1 through 10 were designated Group L, thus represent-ing subjects low in classificatory flexibility (according to the measure employed). Those subjects in rank order 11 through 20 were designated Group H. This group considered to reflect a high degree of flexibility.

Upon examination of individual anecdotal observations recorded throughout task performance, consistent behavioral characteristics were revealed among the designated groups. These consistencies are summarized as follows. For illust-rative purposes, task performances of two selected subjects (one subject representative of each designated group) are described in greater detail in Appendix E.

Characteristics of Group L Subjects (Low Flexibility)

The procedure for sorting employed by this group in performance of the CWST generally involved a process of elimination. After perusal of the stimuli presented, a small group of words was typically selected from the entire

array and piled up or set aside without comment. The next group of words was selected from the remaining number of stimuli. This procedure was generally extended until all word cards were used or only one or two cards remained. Only at this point was an attempt to label or provide verbal explanations for each selection begun. In many instances, difficulty in formulating and expressing titles for the groups produced was apparent. Comments such as "I'm not sure what to call it ..." (Subject 4) were made. Probes were frequently required to obtain reasons for the groupings, thus implying either a lack of consciousness as to the bases of selection or an inability to communicate intent on the part of Group L subjects. Titles when forthcoming were often imprecise and were expressed by phrases of several words. For example, a title such as "you talk to another person with it" (Subject 19) would be more typical of this group than would a single-word title _ "Communication" (Subject 2).

Throughout task performance, a general lack of confidence was revealed by hesitations, facial expressions and the tentativeness of responses. Subjects frequently appeared to seek approval or direction, as evident in comments such as "Is that okay?" (Subject 14) and "Could that be a group?" (Subject 9). Inattentive behavior was also observable, as reflected in such actions as looking around the room or fidgeting.

Upon examination of the composition of the groups formulated, a considerable degree of repetition both with

regard to exemplars and titles was evident. With each
re-sort, it appeared as if previous performance were for-
gotten. Thus an identical basis for selection might be
employed a second time (including an additional word member)
or the same exemplars might be assigned a more precise title
during subsequent sorts. Such occurrences, however, appeared
to be more accidental than deliberate since at no time did a
subject within this group express a conscious awareness of
such repetitions.

Performance characteristics thus observed may have been
affected by the stimuli employed or other factors such as
general ingelligence, reading ability or cognitive style.
Whatever the determinants of performance, however, this
group of subjects appeared to be characterized by a lack
of flexibility in classification strategies. If similar
behavior were evident in a classroom setting, a necessity
for expansion of available strategies through instruction
might be implied.

Characteristics of Group II Subjects (High Flexibility)

The most apparent characteristic distinguishing subjects
within Group L was a tendency to select words according to
an organizing idea or title and actively search for word
members which might fit this criterion. Following a
visual review of the stimuli to be classified, groups were
quickly selected and identified. In most instances, subjects
within this group first supplied a title for each organization,

then recorded the items selected for inclusion. Frequently
a verbal explanation was provided during the sorting pro-
cedure itself as illustrated by the comment "I know, I'll
pick out special events .. like things used for races ..."
(Subject 13). A considerable degree of such thinking aloud
was observed throughout task performance.

Among subjects within Group H, a display of confidence
and motivation to perform well was apparent. Once the task
was begun, these subjects appeared to concentrate and work
independently. At the same time, they frequently volunteered
verbal explanations of the procedures being employed.
Attempts to communicate the system of recording used were
also frequent, as revealed by the comment "I'll circle these
titles so you won't get confused" (Subject 5).

Unlike subjects within Group L who tended to respond
to stimuli on a more concrete level, subjects within Group H
seemed aware of various levels of meaning which might be
interpreted. Accordingly, responses were frequently quali-
fied by such comments as "I'm putting truck in with this
group because it could be a toy" (Subject 5).

Word groups formulated by Group H subjects more
frequently included large groups than was apparent in the
case of Group L subjects. Little repetition of exemplars
or titles was apparent throughout the sorting procedure.
Such repetition was consciously avoided by some subjects
within this group who visually reviewed their recorded
responses during the course of task performance. Similar

behavior was notably absent in the case of Group L subjects. Titles were frequently revised in an attempt to improve degree of precision. For example, "things that fly" was changed to "air transportation" during the recording procedure (Subject 5).

Strategies for organization of stimuli, although varied, were frequently apparent during the performances of Group H subjects. In some instances, a large number of words was selected and identified as a group, then separated into sub-groups (for example, formulation of a group entitled "transportation" broken down into three groups "water transportation", "air transportation", and "land transportation"). Another common organizational method employed was that of contrast, evident in selection of a group designated "large things" immediately following a categorization of "small things".

In general, subjects within Group H appeared to be conscious of the classification process itself. Perhaps this awareness is related to flexibility of available strategies. Further investigation in this regard might well be pursued.

VI COMPARISON OF PERFORMANCES FOR BOYS AND GIRLS

To examine possible mean differences between male and female performance, t-tests were calculated for the number of responses produced, the time required for task completion, and the proportion of responses within each category. Table 6 portrays the relevant data.

As indicated by this table, no support is offered for the reported tendency of boys to employ a descriptive style to a greater extent than do girls. (Kagan et al, 1963; Witkin et al, 1962; Wallach and Kogan, 1965). In both tasks employed within this study, a smaller proportion of responses classified as descriptive were given by boys as compared to girls. This may have been a factor of the particular subjects selected, the stimulus materials employed or the method of analysis used. No significant differences between male and female performance with regard to quantity or speed of response were revealed (Table 6).

It may be concluded that classificatory behavior appears to vary according to the requirements and materials of the task to a much greater extent than it does to sex.

TABLE 6

SEX DIFFERENCES IN CLASSIFICATION BEHAVIOR

VARIABLE	MEANS		
SCST	Girls (N=10)	Boys (N=10)	t*
Number of responses	28.4	38.9	-1.649
Time on task (minutes)	9.5	9.8	-.232
% Descriptive responses	32.8	29.2	.849
% Relational_contextual responses	37.6	38.7	-.182
% Categorical_inferential responses	27.7	24.1	.837
CWST			
Number of groups	15.7	15.3	.142
Time on task (minutes)	24.5	23.8	.205
Multiple Classification Index	3.961	5.593	-1.417
% Descriptive response	11.0	6.7	1.075
% Relational_contextual responses	34.6	38.7	-.616
% Categorical_inferential responses	53.1	53.5	-.054

* t=2.101 significant at 0.05 level (df=18)

Note: Percentages of responses do not equal one hundred since those responses classified as miscellaneous have been excluded from the above analysis.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

A brief summary of the study and an outline of the
findings are presented in this chapter. Conclusions which
may be drawn from these findings are discussed, and recommend-
ations for further research made. Based on the findings,
implications of the study are suggested.

I SUMMARY

The main purpose of the study was to examine the methods
or strategies of classification employed by a group of eleven-
year old children. By eliciting sorting behaviors and verbal
explanations for responses, insight into the processes under-
lying concept development was sought.

The sample for the study consisted of twenty students
at the age of eleven years plus or minus four months drawn
from one heterogeneous classroom in the Edmonton Public
School system. An equal number of girls and boys was
included in the sample.

Two distinct tasks were employed within this study.
The first was an adaptation of the Sigel Cognitive Style
Test. Individual classification strategies were determined
by an analysis of pictorial stimuli which were grouped and
verbally rationalized. The second task, termed the Coull
Word Sort Task, was designed by the investigator as an

alternate means of exploring classification strategies.
The sorting of verbal stimuli and naming of designated
groups were analyzed using a common criteria. In addition,
percentile scores on the vocabulary sub_test of the
Stanford Achievement Test in reading were obtained and
used for purposes of comparison.

All subjects were individually interviewed on two
separate occasions. Responses were tape_recorded, trans_
cribed and analyzed according to a common classification
schema. In addition, anecdotal observations were recorded
throughout task performances.

II FINDINGS AND CONCLUSIONS

Major Research Questions

QUESTION 1: What is the nature of classification strategies
employed by eleven_year old children as revealed
through verbal explanations of performance on
sorting tasks?

A wide range of both inter and intra_individual
differences in classification strategies was revealed
through task performance. According to the common schema
for analysis of responses provided, no single strategy was
employed by an individual subject or by the group of
subjects. Rather, the four bases of classification outlined
(miscellaneous, descriptive, relational_contextual,
categorical_inferential) were all represented within the
total group responses on both tasks. Proportionately,
however, the predominant means of classification displayed

was found to vary with the stimulus materials employed.

In performance of the Sigel Cognitive Style Test (which employed pictorial materials), the highest proportion of responses for the total group was classified within the relational_contextual category (as defined in the study). This proportion represented 36% of the total responses provided. The next highest occurrence was within the descriptive category (elsewhere termed 'analytic'). This proportion represented 31% of the total responses provided. Finally, 26% of the total responses were classified as categorical_inferential.

Such findings appear to be contrary to those reported by other investigators (Kagan et al 1963, Kagan et al 1964, Sigel 1965) who report "a linear developmental trend from relational to analytic conceptual styles in children ranging from age six to twelve" (Denney, 1971, p. 142). As suggested within the study, however, an explanation for this apparent discrepancy may be found in the criterion of analysis employed.

In performance of the Coull Word Sort Task (which utilized verbal stimuli), the highest proportion of total group responses (53%) occurred within the categorical_inferential category. This was followed by a proportion of 35% of total responses within the relational_contextual category and 11% within the descriptive category.

This variation in the incidence of proportionate responses between the two measures of task performance may well be a function of the stimuli employed rather than a reflection of conceptual styles or preferred strategies. The higher incidence of categorical-inferential responses indicated by CWST performance may be a factor of the abstraction level inherent in the verbal stimuli employed. Conversely stimuli presented in pictorial form (as in the SCST) may encourage a more stimulus-bound response enabling a direct relation to the objects depicted.

Thus it may be concluded that individual classification strategies appear to vary in accordance with the form of the information to be processed. In future investigations, it may well be determined that multiple cognitive styles of an individual must be taken into consideration in any explanation of his behavior and performance.

QUESTION 2: What is the incidence and nature of dominant or preferred strategies for classification displayed by children of this age level?

Within the study, dominant preference was defined as "an incidence of at least forty percent of answers within a particular category and at least ten percent less in any other category". (Lundsteen, 1974, p. 271). According to this criterion, the incidence of dominant preference as revealed by task performance was proportionately determined.

Upon analysis of performance on the SCST, 25% of the subjects displayed a dominant preference for relational-

contextual classification strategies, 15% for descriptive strategies and 5% for categorical_inferential strategies. No dominant preference was evident, however, for 55% of the subjects.

Upon analysis of performance on the CWST, varied results were obtained. 55% of the subjects displayed a dominant preference for categorical_inferential strategies on this task, 15% for relational_contextual strategies and 0% for descriptive strategies. No dominant preference was indicated for 30% of the subjects.

Only one subject displayed an identical dominant preference on both tasks. Three subjects consistently re_vealed no dominant preference. For the majority of subjects (80%), however, dominant preference displayed was seen to vary with each task.

These findings support the theory expressed by Lundsteen (1974) that incidence of a distinct preference varies according to the nature of the materials employed in the assessment.

QUESTION 3: Is it possible to devise some means of determining the degree of flexibility within classification?

Previous research has suggested that breadth of catego_rization is reflected in the number of groups devised within a free_sorting task. Since the CWST allowed for variation in the number of groups generated as well as the number of stimuli selected as exemplars, analysis of individual task performance enabled the formulation of a Multiple

Classification Index. This index represents the total number of items sorted divided by the total number of groups produced, and is considered to represent some measure of flexibility.

Multiple Classification Indices thus determined were found to vary considerably (from 2.21 to 13.59). Thus a considerable range in flexibility appears to be indicated within the sample as might be expected with a heterogeneous group of similar-aged children.

QUESTION 4: What is the relationship between flexibility of classification and performance on a standardized vocabulary test?

For purposes of comparison, percentile scores on the SAT Word Meaning sub-test were correlated with Multiple Classification Indices as determined for each subject within the sample. The relationship between these measures was investigated by means of statistical analysis. A correlation of +.403 was determined which approaches significance at the .05 level.

Although statistical significance is not strongly indicated, certain trends in performance were noted. Low SAT scores more commonly coincided with low Multiple Classification Indices than did high SAT scores and high Multiple Classification Indices. This coincidence may have been a factor of sample selection or may indicate a possible connection between flexibility of classification strategies and vocabulary achievement.

QUESTION 5: Are there observable differences in performance
behavior among flexible and inflexible
categorizers?

For purposes of comparison, subjects were ranked in
order of Multiple Classification Indices. Two groups were
distinguished, and common behavioral characteristics within
each group were examined through reference to anecdotal
observations recorded throughout task performance. Consist-
ent characteristics were revealed as summarized below:

Inflexible Categorizers

1. process of elimination employed

2. difficulty in formulation of titles for groups revealed

3. frequent probes necessary

4. titles often imprecise

5. lack of confidence indicated

6. frequent repetitions

Flexible Categorizers

1. selection according to an organizing idea

2. verbal explanations volunteered

3. diverse interpretation of verbal stimuli

4. voluntary revision and review

5. consistent strategies apparent

Performance characteristics thus observed may be
attributed to several related factors. Whatever the
determinants, however, variation in the degree of flexibility
displayed among eleven-year old subjects was readily apparent.

QUESTION 6: Are differences in performance of preferred
strategies evident between boys and girls
at this age level?

To explore the possibility of mean differences, t_tests
were calculated for various aspects of male and female
performance. Factors thus examined included the number of
responses produced, time required for task completion, and
the proportion of responses within each of three categories
(descriptive, relational_contextual and categorical_
inferential).

No significant differences in performance were deter_
mined. Such findings are contrary to those reported by
previous investigators who assert a tendency on the part of
boys to employ a descriptive or analytic style to a
greater extent than girls. Within this study, a smaller
proportion of descriptive responses was indicated for male
subjects in both measures of task performance employed.
Thus from the present study, it may be concluded that
classificatory behavior appears to vary with the materials
of assessment to a greater extent than it does with sex.

III RECOMMENDATIONS FOR FURTHER RESEARCH

The following suggestions for further research are proposed:

1. A replication of this study using a larger sample and/or subjects with a different experiential background might reveal the extent to which task performance may be influenced by similar instructional methods or materials.

2. An attempt might be made to obtain data concerning classification strategies within a classroom setting. Methods for the CWST might be revised so as to enable group assessment of performance. By standardizing procedures for the recording of responses, individual diagnosis might be conducted as required.

3. A need for further investigation of the effects of stimulus materials on classification strategies as well as the incidence of dominant preference is indicated. An analysis of performance at various age levels according to stimulus materials employed would provide valuable insight into the processes involved.

4. A longitudinal study might explore the incidence and stability of dominant preference with age.

5. Further validation of the Multiple Classification Index is required. The relationship between this measure and that available from SAT or another vocabulary test might be investigated with a much larger sample.

6. The relationship between intelligence, creativity, and classification strategies requires further investigation and clarification.

7. A further investigation of classification strategies employed by boys and girls at various age levels might clarify whether differences in performance are related to sex, age or other factors.

IV IMPLICATIONS OF THE STUDY

Based on the findings of this study and those of the research reviewed herein, a number of implications for instructional theory and practice are suggested.

As noted within, the methods and materials of assessment employed may affect any indications of conceptual style or strategy displayed by an individual. Thus it is imperative that research be interpreted according to the criteria applied if conclusions are to be drawn from the findings presented. Furthermore, since stimulus materials appear to influence the processing involved, a variety of instructional modes should be employed within the classroom so as to allow for individual preferences as well as to expand the repertoire of classification strategies which may be employed.

Since concepts are acquired through the organization and interpretation of perceptual experiences, the active involvement of the child with his environment must be emphasized. Although opportunities for direct exploration are frequently provided within the early years of school

instruction, too frequently the prerequisite experiential background is assumed in the higher grades. Unless the necessary foundation for meaning is provided, the perpetuation of meaningless information occurs. Our concern must progress beyond the imparting of facts to an expansion of thinking abilities. As Moffett (1968) contends, "learning and learning how to result in very different kinds of knowledge".

Undoubtedly, children's concepts change with age and experience. Yet it is not enough to trust that such development will 'naturally' occur if the child is left to his own devices. The need for guided explanation by the teacher is both necessary and crucial. As Hayakawa (1941) warns:

> Experience itself is an extremely
> imperfect teacher. Experience does
> not tell us what it is we are
> experiencing. Things simply happen.
> And if we do not know what to look
> for in our experiences, they often
> have no significance to us whatever.
> (p. 259)

In order to plan an instructional program which will enhance conceptual development, however, some means of diagnosing both the type and level of individual cognitive abilities present becomes necessary. Such diagnosis has traditionally relied upon standardized vocabulary test performance. Although the role of words in concept development is generally conceded, conceptual development

and verbal ability are seldom synonymous. By examining
the strategies of classification employed and behavioral
characteristics displayed by an individual, insight into
his or her abilities and needs may be gained. In the
words of Jerome Bruner (1973):

> Once we have formulated a view of
> man's intellectual growth that takes
> into account the formal properties
> of thought, considers the instrumental
> nature of thought, responds to the
> cultural patterning of intelligence
> and places man in an evolutionary
> context, let us also ask whether we
> have contributed to our understanding
> of how to educate man to the point
> where he can use his intellectual
> heritage to the full. (p. 316).

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APPENDICES

APPENDIX A

BASES FOR CLASSIFICATION — CWST

APPENDIX A

POSSIBLE BASES FOR CLASSIFICATION

OF STIMULI IN COULL WORD SORT TASK

As part of a validation check, the following were determined as possible bases for classification of the selected stimuli:

(1) word analysis

(2) common parts or attributes

(3) similarity of size

(4) similarity of shape

(5) common location

(6) common action or activity

(7) similarity of non-observable qualities

(8) common association with particular seasons

(9) common association with ages or types of people

(10) common use or function

(11) common source of power

(12) common materials.

APPENDIX B

DIRECTIONS _ SCST

APPENDIX B

Directions Given to Each Student Before
Administration of the <u>Sigel Cognitive Style Test</u>.

"This is a set of pictures of many familiar objects. Each
set contains three pictures. In this first set (displayed in
front of subject) are three pictures _ a tomato, a pear and an
apple. We'll do this one together as an example.

What I want you to do is to pick out the things that go
together, belong together or are related in any way and give
a reason for each choice. Give as many pairs as you can. Let's
try this first ...

That's fine _ that's just what I want you to do for the
rest of the pictures. For each set, find me the ones that
belong together and tell me why they go together". Any questions?

If no questions regarding directions were forthcoming,
the investigator activated the tape recording equipment and
turned the binder containing the stimulus materials to Picture
Set A.

APPENDIX C

DIRECTIONS _ CWST

Directions Given to Each Student Before
Presentation of the Coull Word Sort Task.

"This is a pile of words that can be classified in many
ways. I want you to look the words over and put the ones that
seem to you to belong together into groups. There are no right
or wrong answers. The groups you choose may be large or small,
any size you want as long as the words belong together for a
reason.

Once you make all the groups you can, I want you to write
down all the words in each group and give each group a title or
label. Don't worry about spelling. If you prefer, you may
dictate the words to me.

Take your time — there's no need to hurry. Remember, your
groups can be all different sizes. Okay, go ahead".

APPENDIX D

APPLICATION OF CLASSIFICATION SCHEMA _ SCST

APPENDIX D

The following are examples of the types of responses classified according to the classification schema employed.

Stimulus Reference Picture Set	Verbatim Response	Assigned Category
M	"they're both big"	D_1
A	"they're both ladies"	D_2
I	"they're both children"	D_3
K	"they all have four legs"	D_4
C	"both made out of wood"	D_5
J	"the man and lady might go on dates"	R_1
B	"they both belong in the water"	R_2
B	"they both lay eggs"	R_3
J	"these two are bigger than this little one"	R_4
I	"she could be their mother"	R_5
N	"they all help the community"	C_1
C	"they're all furniture"	C_2
H	"they're both furry"	C_3
I	"they're both unhappy"	C_4
I	"they're both bad"	C_5

APPENDIX E

ILLUSTRATIVE SUMMARIES OF TASK

PERFORMANCES _ CWST

The following summaries were compiled from observational records made during task performance on the CWST. Two sub_jects' performances are described for illustrative purposes.

Subject A (Female, Multiple Classification Index 3.15)

Following the explanation of directions, Subject A went through the deck of word cards by individually picking them up, reading them, and putting them into another pile or setting individual word cards aside. After a considerable amount of shuffling cards from one pile to another, five groups were designated (leaving one word card unassigned). Performance was silent throughout.

Exemplars of group one were listed, and after a lengthy pause a probe for a title was expressed by the investigator. A verbal response (automobiles") was provided and the title accordingly recorded. After another pause, a probe for a title for the second group was expressed. This time, the title was tentatively suggested with the intonation of a question ("sky cars?") and accompanying eye contact indicating a search for approval. Following a nod, the title was recorded. The third title was again tentatively suggested ("would water cars be okay?") before recording.

Prior to the re_sort, a question regarding directions for the task was stated: "Could you put them all together and put them into groups in a different way?" Although such an enquiry may have indicated uncertainty as to the procedures to be followed, it might also be inferred to be a request for re_assurance.

Throughout this second sort, each card was carefully studied before placement within a group. Once again, a process of elimination was employed. Items within each group formulated were listed, and titles voluntarily recorded. A similarity within titles was noted (for example, "sailing things", "flying things", "motor things"). One title provided during the first sort - "electric things" - was repeated, this time with fewer exemplars.

Following a suggestion to display the entire array of stimuli, a third and final sort was accomplished. Words were predominantly placed in pairs. Further evidence of repetition was apparently unnoticed by the subject. Non-verbal behavior such as sighing and looking around the room was interpreted as an indication of task completion.

In general, it was inferred from task performance that a lack of available approaches to classification was common among this group of subjects.

Subject B (Female, Multiple Classification Index 5.27)

Following the explanation of directions, Subject B picked up the deck of word cards and carefully read them aloud. Cards were then sorted into three piles, each card being placed in a previously organized group, until the entire stimulus array was distributed. A comment of "Okay, let's see now .. I've got them into three groups already" was followed by a listing of the first title "things around the house". The five items within the group were then appropriately labelled. With the writing of the second title

("transportation") an explanation of why one particular item was included within the group is contained in the statement "I picked crutches in this group because without crutches a person with a broken leg wouldn't be able to walk at all!" The next title was written as "fun things" but quickly revised to read "things for fun".

The entire deck of word cards was quickly picked up again, and immediately sorted into 8 piles, thus suggesting that this sort was conducted according to organizing ideas which may have been evoked by prior exposure to the stimuli. During the course of this sort, some whispered monologue was apparent in the decision of group inclusion as revealed by such comments as "Okay that belongs ... no, not that". Frequent smiles and chuckles were observable throughout the performance. Once again, titles were written first. Each pile was set aside after being recorded. As the word "letters" was printed with crossed ts (as part of a title), the comment "that's two t's ... that's the way I like to make them" was volunteered, thus illustrating the concern with communication evident throughout the performance.

Nine such sorts were produced with frequent verbal accompaniment and explanation. Before the suggestion could be given to display the entire array, the subject commented "I'm so used to putting things into groups ... it's time I had a great big look around these things!" and spontaneously employed this procedure.

Evidence of both creativity and a fine sense of humor were apparent throughout her performance, factors which may or may not be related to the flexibility of classification displayed.

B30181